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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

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COMPUTER AIDED INSTRUCTIONAL COURSE AUTHORING: AN EXAMINATION OF THE PRE-RELEASE VERSION OF MAESTRO IN DEVELOPING A COURSE IN NAUTICAL RULES OF THE ROAD

by

Clark W. Crabbe

December 1987

Thesis Advisor: Taracad R. Sivasankaran

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Computer Aided Instructional Course Authoring: An Examination of the Pre-Release Version of Maestro in Developing a Course in Nautical Rules of the Road

by

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

This thesis examines computer aided instructional course authoring using the Maestro system. A test course was written using International Rules of the Road as the course content; some comparisons are made with M.1 as a system; recommendations for continued study using Video Disk equipment as a storage medium are made.

Thesis
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I. INTRODUCTION

The low cost and reliability of the microcomputer has created an entire new field in computer aided instruction. Courses that once required an instructor to teach fundamental concepts have begun to be replaced by self-paced courses using a microcomputer as a teaching tool. In situations where the material is basic and an approach of see and then do can be applied, a properly conceived and well written course which uses a microcomputer as the instructor can be very effective.

Until recently, courses which were developed for computer aided instruction required an experienced programmer to work with the instructor to gain insight in the course and then translate that knowledge to a source code which would create the proper screen displays and lesson text. This is an expensive and time consuming process. Now programs such as Maestro are available or are in development which require little programming skills to use but generate highly satisfactory courses. This means that the instructor is now able to create the course without the assistance of a programmer.

The purpose of this thesis is to examine the pre-release version of Maestro, a computer aided instruction authoring system. (Maestro is fully described in Chapter

III). As the vehicle to demonstrate this system a course was developed on Nautical Rules of the Road. Nautical Rules of the Road are the international conventions which govern the traffic control and signalling methods and devices between vessels at sea. The knowledge of these rules is required by all operators of vessels on the high seas. The Navy currently teaches these rules in a class-room enviornment yet the topic lends itself well to computer aided instruction. The courses are currently being taught at several locations and the information is refreshed at frequent intervals in the career of each line officer. The use of a computer aided instruction system would provide not only an effective teaching tool, but would also make an excellent device for refreshing officers on the current rules. The approach was to see if a person knowledgeable in a subject could take the Maestro manual and develop usable course of instruction.

Consideration was given to the human factors involved in the development of computer aided courses, such as displays, testing, reinforcement practices, and length of time effective in presenting any one module of the course as compared to attention span of the user. In general it was found that Maestro has been developed with much of this in mind and as a result it makes development of a high quality course by a person without extensive programming skills easy and effective.

Conclusions reached are that Maestro provides a tool for educators which puts the development of quality computer aided courses at an inexpensive level. While there are some problems with the program in some functions, contact with the developer has indicated that these will be corrected in the final release version. This system could provide the Navy with a method of making more courses available for initial training as well as recurrency courses for shipboard use.

Recommendations include continuing this research with regard to test courses using the full range of Maestro features. In particular the ability to use filmed images placed on a 12 inch laser disk which provides actual images of the material taught, such as images of actual ships at sea in various conditions, combined with the audio capabilities of Maestro, provides this system with an unusual and effective means of information exchange. Contact has been made with the Naval Education and Training Command and the response has been one of genuine interest. Pursuit of additional research funded by them has been indicated as a possibility.

II. METHODOLOGY

Traditional course authoring has required the combining of skills of the programmer and the educator. Most often the educator did not have the programming skills to develop the necessary code so a programmer was called in to translate the information to a machine usable form. While the result was a complete course, the expense and time involved often made the project not cost effective. When changes became necessary in the course material, the programmer was again called in to implement them. This cycle was repeated each time a change became necessary.

The direction of this research was to find an easy to use system of course development which would require little programming experience and still provide a quality course. In addition, whatever system used, it must be compatible with equipment currently in use in the fleet and shore activities. This meant that the system must operate with the DOS operating system as applied to IBM-PC/XT/AT type systems.

The first system examined was M.1. M.1 is an artificial intelligence shell developed by Teknowledge Inc., with applications on many machines from mainframe size to IBM-PC/XT systems. M.1 is not difficult to learn to use, but it does require that the user be familiar with sound structured programming techniques. M.1 uses Rules input which are searched in response to Questions which are programmed in. The system will ask a Question, search for the applicable Rule, and respond with an answer or series of possible answers with levels of confidence. It is capable of interfacing with C programming language to run subroutines such as screen graphics and sound generation. Although M.1 is not difficult to master, C is.

A good instructional course must include appropriate screen displays which depict the material to be taught in a clear manner. In the case of rules of the road, this means that graphic display of lights, shapes, and maneuvering situations must be shown to reinforce the written text of the course. The only way to do this with M.1 is to use C which requires considerable programming expertise.

Because of the necessity of using C with M.1, this approach was quickly rejected. The objective of developing a course by the instructor without the aid of a programmer or without extensive knowledge of a complex language, in this case C, could not be achieved.

Maestro was next considered as a possible tool and was found to meet the requirements of ease of use, extensive graphics capability, and the unusual ability to interface with a video disk player. The ease of use is achieved by the use of an object oriented user interface which requires only selecting an object or objects and then doing one of two things, either build structure or add content to the structure. All objects are represented as icons such as START, LOOP, PLAYER, SAVE, and other objects which do just what they say. The advantage is that a complex programming language and correct syntax use is not required. All operations become intuitive as described by the icon.

Because of the simplicity of operation and extensive capability built into the software, Maestro was selected as the test system for this research.

III. MAESTRO

Maestro is a computer based authoring system. Designed to operate within the framework of Microsoft Windows, Maestro is a user friendly, easy to learn course development tool. Use of Maestro is generally an intuitive process, simply point to the desired function and actas requested. Development of a course becomes a matter of defining the gross structure and then filling in the content.

Maestro is invoked after loading Windows. Using a mouse system of pointing and selecting, the screen will display an area to build the course in and an Icon Library. The development screen is really a portion of the available area, which appears to be limited only by machine memory, the window can be moved over the course area much like putting a small square over a large spread sheet. The Icon Library is also expandable to show the entire library. I found the best way to use this was to expand the window to full size and then drag the window to the bottom of the screen when not in use. This left the entire course area open for viewing. The development process was then one of selecting an icon from the Icon Library, and then building on the development screen.

Maestro calls the process of development Symbolic Authoring. This process was developed by AIMtech and works as follows: first the structure of the course is assembled using the icons which depict the desired action or event. Content is then added to each icon which is accomplished through the use of Dialog Boxes. The dialog boxes contain blank areas following requests for information. If a question arises as to what to enter, a Choices selection can be made which will explain what is desired. If a file or action which is stored is requested and Choices is selected, Maestro will provide a listing of the available files. Simply indicating which file is desired by pointing to it with the mouse will enter it into the icon.

As each block of the course is placed on the screen it will have a color which indicate one of several things. Purple indicates the icon currently selected for use, either by an editor/dialog box or for construction from the Icon Library. Red indicates an icon which has no content or, as in the case of icons which have default values such as PAUSE, has not been changed by the author. Yellow indicates that content has been added to the icon. Green is reserved for complex icons. The complex icon is what I consider to be the most powerful tool in the Icon Library. This allows the author create a substructure of as many icons as necessary to define a desired operation and then compact that topology into one complex icon. This makes the gross overview of the course structure much more readable. This subject is covered in more detail in the next chapter. Light Blue is used for

ARROW icons which indicate that more structure exists off the screen. By selecting this icon on the structure chart the view is expanded to show the new or hidden structure.

Depending on the icon selected for use, any one of a number of editors may be invoked. Again, if a question arises as to what to do, simply choose the CHOICES selection and the available items will be displayed. Although some of the editors sound good, not all of them work as described in the manual, and some are inoperative in this version. The next chapter on evaluation will fully cover each feature of Maestro and limitations/problems discovered.

IV. EVALUATION OF MAESTRO BY DEVELOPING A COURSE

To provide a basis for evaluation of the Maestro system I developed a course in Nautical Rules of the Road. The objective was to attempt to create a complete, stand-alone course which included instruction, graphics, and testing capability. The ability to allow the instructor to develop the course without extensive programming skills was paramount. To achieve this end I developed the course by reading the Maestro manual [ref: 1] and proceeding directly with course development. Structure of the course was straight forward implementation of the international portion of the Navigation Rules [ref: 2].

The course was broken down into sections which were to be menu selected; (1) General Rules, (2) Steering and Sailing Rules, (3) Lights and Shapes, (4) Sound Signals, (5) A Final Test. The original intent had been to assemble the course, obtain film of desired graphic sequences to be pressed to a Laser disk, and demonstrate the video disk player. As development of the course proceeded it became clear that the laser disk portion would not be accomplished due to development time available and funding restrictions. All graphic representations were therefore created using the Maestro graphics editor.

Initial set up required the following minimum equipment:

1. IBM-PC/XT with 640K memory
2. Mouse pointing device
3. Enhanced Graphics board and Display
4. Two 360k floppy disk drives
5. Video Overlay board for the player
6. Microsoft Windows

The Maestro Manual states that a hard disk is recommended but not necessary. In fact I found that the system could not be set up without a hard disk. After using the system this became clear as to why but it should have been stated in the manual. The system is disk use intensive and had I been able to run it on a two floppy system I'm sure I would have quickly gone insane.

Although an enhanced graphics capability is required, the system uses only the CGA capability in 640 by 200 pixel resolution. This causes the graphics to be less than optimal but was sufficient for testing. In actual use the laser player would make this feature unimportant. However from a development standpoint the EGA monitor creates excessive eye fatigue due to the flicker rate.

The specification for an XT system is correct but is actually not good for development. Using a standard IBM-PC/XT running at 4.77 Mhz was painfully slow. As the program became more complex, wait times for icon selection, cut and paste operations and similar features which required memory manipulations took up to 3 minutes to accomplish.

Installation of an accelerator card in the system greatly helped reduce these times. I consider this to be a necessity. Ideally an AT class machine would be used for the development process. Actual execution of the finished course was conducted on a standard XT and the execution times were excellent, thus the requirement for the course to run on currently available equipment was demonstrated satisfactorily.

All figures referred to in this chapter may be found in the Appendix, Course Structure. Figures 1,2, and 3 show the course structure. The rectangular boxes are single icons labeled as they are in the Icon Library. If a file or variable name is included it refers to the appropriate file for that operation. The hexagonal icons are representative of complex structures, the substructure of these icons are depicted in figures 4 through 46.

Referring to figure 1 the start of the course begins with a welcome message. This first attempt at use of the graphic editor provided no surprises. Selecting the GRAPHICS icon from the Icon Library, edit was selected, build down picked from the menu and the GRAPHIC icon appeared below the START icon. Next the graphic editor was selected, the picture was created using the tools provided on the tools list, and the result was saved as Begin.GPH. Returning to the edit menu add content was selected, choices was called and a list of graphic files appeared. BEGIN.GPH was picked and the GRAPHIC icon changed from purple (selected) to yellow (content added). The steps were all intuitive and easy to accomplish.

The next step was to create the menu structure. Selecting the MENU icon and building down on the structure, the system automatically added the required LOOP icon and substructure necessary to create the MENU operation. This is a strong point in Maestro. Whenever additional icons are needed to make a function work, it automatically adds them thus not requiring the developer to understand the programming techniques but to merely fill in the required icons with requested information. When the add content portion of the edit menu is selected, the system will proceed through each icon necessary to make that function operate and ask for content.

The manual is not clear on how to handle input from the keyboard but a few minutes of experimentation showed that any variable must be preceded by @ followed by any name you choose. If future use of this variable is needed or if it must be called up later it may be saved by the SAVE VAR icon. Here the first major problem was discovered. The first variable saved is not really saved. It disappears. To get around this I saved the first input as a variable but never used it. This meant that the later variables to be used in the Test section could be saved and thus recalled for score computation. This is a minor problem but one of those things that keep you up all night trying to figure out.

I wanted the input from the student to be from the mouse for selections but was never able to get the Location Editor to define a large enough 'hot spot' to be useful. Also I was not able to define numerous 'hot spots' on a single menu representation. The manual calls for use of the Area Editor to accomplish this but I could never get it to work. This is a valuable tool which needs to be functional in the final version. The net result of all this is that menu responses must be entered from the keyboard. Not optimal from the human factors point of view because the student must now decide which device to use, mouse or keyboard.

Once the menu was developed it was a simple matter of creating the structure of figure 2 through the pause icons. Each graphic is a heading for that section of the course. The complex icons below contain all the information and display graphics for the rule number listed. I started work on the lights and shapes section first because of the large number of graphics representations necessary. Figure 26 is a good representation of a typical complex rule, in this case rule 25 dealing with sail vessels. The rules were copied from the Navigation Rules [ref 2] using the notepad feature of Windows. I found that if I tried to use the text editor in Maestro, the entire system would lock up. To get around this problem I would use the Notepad in Windows to create the text portions. The manual states that Maestro can read any ASCII format text but I found that in fact only Notepad would work. I tried Wordstar in non-document mode but there were still control characters present which appeared when the file was run inside Maestro. In any case the Notepad is available at all times when running Maestro but here the slow speed of the XT became an annoyance. When Notepad is called up, Maestro is put in the background, once the operation with Notepad is completed, it can take up to 3 minutes for Maestro to be re-loaded and ready for use.

At this point it became clear that choosing an icon, adding content, and then repeating was a slow process. Noting that much of the structure of the course is repeated, I used the COPY function to copy the built portions of the course containing GRAPHICS and TEXT. Instead of running between the Icon Library and the work area, I was now able to simply use the PASTE command to build rapidly. I also pre-planned the text and graphics I needed so that once in the Notepad I created all of the necessary files at one time. The graphics were done in the same manner. To save time in the creation of the images and to provide some measure of uniformity, a basic vessel shape for large vessels and small vessels was created. This file was opened in the graphic editor and changes were made as necessary for the desired graphic and then saved as a different file name.

In this way the creation of the numerous graphics images was made substantially easier.

The use of so many graphics displays brings up the reason the Video Disk Player is the best way to go. Each graphics file requires 48Kb of mass storage. This course has over 65 graphics files which take up a good portion of the hard disk. To make the course usable for another machine 16 floppy disks are needed to transfer the files. This is not really a portable program, however if the same course were created using the Video Disk Player as the mass storage device, the entire course would require one floppy disk with the program code and one laser disk with the video information. An added feature of the Video Player is the ability to reproduce all types of sound in stereo. This would have been excellent in the Sound Signals portion of the course as actual ships' whistles could have been used. The stereo feature adds the ability to test for recognition of the correct rule with regard to position of the vessels.

One of the development features that I feel this system needs is the ability to drive or control a Video Tape Player. By having the ability to use tape, the author could then film many scenes, test them in the course and when the right combination is found have the laser disk created from a tape master. Currently the author must fully develop the required video and audio portions of the course and have the disk created with no way of testing the product.

Considering the cost of each laser disk master at over $2000, this method might save in development costs. The tape would be far too slow for the operating course but for development it provides a necessary flexibility missing in this section of the Maestro Package.

The final result of the created package was course in Rules of the Road which were functional and complete. To change from the graphics files now used to a video disk display would only require creation of the disk, cutting the GRAPHICS icons in the course structure and replacing them with the PLAYER icon. Adding content to the PLAYER icon is simple as the Video editor appears to function correctly.

The final result of the course developed was a complete package which met the objectives of this research. Maestro is simple to use, requires little or no programming experience, and the results are professional.

V. MAESTRO PROBLEMS

This chapter will list each Maestro feature which did not work as described in the manual or which had poor documentation. A description is given of the problem or any peculiarity discovered in testing. Each feature was tried, several did not work and others had unpredictable results. Although not all features were used in the test course, all were tried.

A. AREA EDITOR

The area editor did not appear to function correctly. I used it to try and define the areas which were to be 'hot spots' for the mouse but all it seemed to define was one small point. This was not enough to make use of the mouse possible for things such as menu selection.

B. COLOR EDITOR

The color editor is not operational. If color is required in a field request then it must be entered in the form of R,G,B which represents the colors and intensities of the red, green, and blue primary colors. This is a minor problem which had no real effect on the usefulness of the graphics editor.

C. TEXT EDITOR

The text editor when called from Maestro would sometimes hang up the system. The only way to recover was to re-boot the system. If the data in the course had not been saved then it was lost. This pointed out the usefulness of the auto save feature of the system which helped reduce lost information to a minimum. There are a series of text control switches which allow import of variables, control of formatting, and various other text manipulations. None of these worked. This is a serious flaw in that formatting of the text in smaller than full screen windows cannot be controlled. To get around this on screens where I wanted text at set points in a specified format, I used the graphics display with text written in graphics mode. This worked fine but does require the storage of another graphics file (48Kb).

D. GRAPHICS EDITOR

The size of the brush or eraser is not displayed. Often the line was of the wrong size and required redrawing. The cut and copy functions also did not work. If the screen color was changed by the use of the fill command then the undo function would not work.

E. ICONS

The save var icon does not save the first variable in the course however this is easy to overcome by saving a dummy variable as the first step in the course. Figure 1 shows how this was done by saving the @response variable.

F. SWAP COURSE

This function allows the user to run two courses at one time. By doing this you are able to copy portions of one course and import them into another course. This is a great feature and it would be most useful in changing the course to a video disk system. Unfortunately it does not work.

G. COPY COURSE

If this function is used the variable editor and the help functions no longer work. This is no real problem because the copy course function is used only at the end of the development of the course and the other functions are no longer necessary.

H. FILE MENU

The print command does not work. All printing of text must be done outside of maestro. The notepad print works fine.

I. SYSTEM REQUEST KEY

Don't push this, it causes the entire system to lock out. This is only a consideration if an AT style keyboard is used.

J. SPAWN

The manual discusses the SPAWN icon as a means of running other programs through DOS while in the course. This is a nice feature for bringing in items such as time and date. The SPAWN icon is not in the Icon Library however so I must assume this feature does not really exist.

VI. CONCLUSIONS AND RECOMMENDATIONS

Maestro is an effective and easy to use system of course authoring. It is structured such that intuitive use of the features will generally result in the correct action. The windowing system of information presentation makes a layered approach to filling in the requested information possible. When information is requested and what is wanted is not clear, the choices selection will direct the user to the correct responses or will show what options are available. The automatic selection of icons necessary to create a stand alone module in all cases is most powerful. It relieves the user of normal programming responsibilities and lets him concentrate on course content.

The complex icon is an excellent example of the thought that went into this system. By combining the sections of the course which are related into one complex function, readability of the finished structure is such that the entire package becomes self-documenting.

Contact with Mr. Bill Hayes of NETC has indicated that interest in systems of this type is high. They currently have no system which will access a video player and the potential for this type of course is immense.

I recommend that further research into this system be conducted with emphasis placed on development of a full course using the video disk player and the complete range of sound and motion presentation possible. Further communication with AIMtech is also recommended and obtaining new releases of Maestro may well resolve some of the problems encountered with the pre-release version. I also recommend that AIMtech be queried on the possibility of installing drivers to allow the use of a video tape player for development and editing purposes.

Considering the current training needs of the Navy, Maestro provides a system which can develop quality course material at a substantial reduction in cost over the current methods of developing computer aided instructional courses.

APPENDIX

COURSE STRUCTURE CHARTS

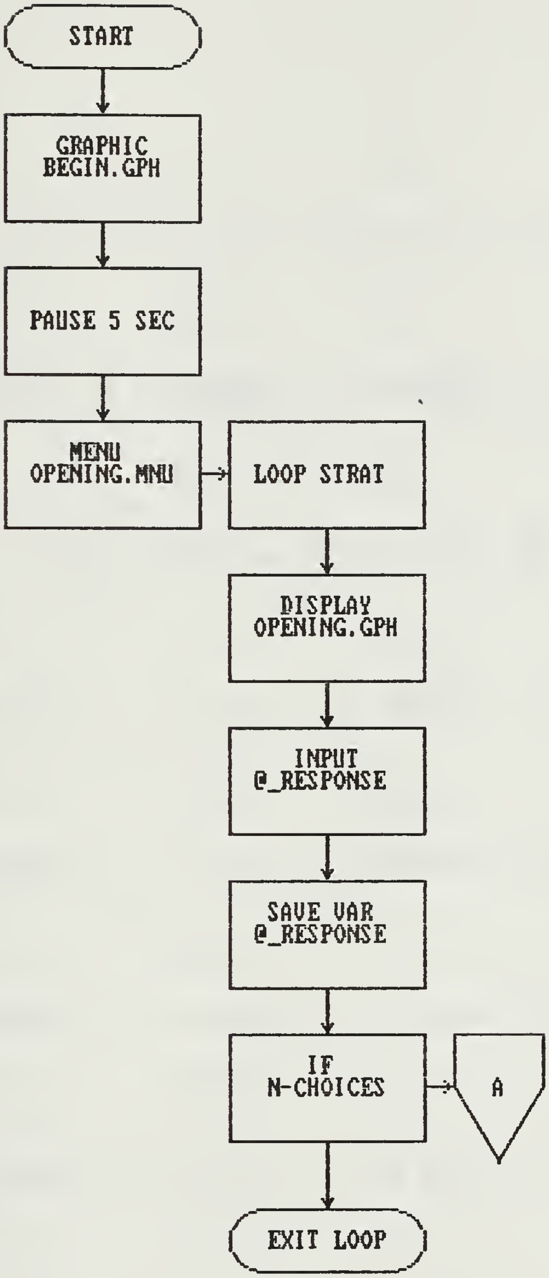

START
GRAPHIC
BEGIN.GPH
PAUSE 5 SEC
MENU
OPENING.MNU
LOOP STRAT
DISPLAY
OPENING.GPH
INPUT
@_RESPONSE
SAVE VAR
@_RESPONSE
IF
N-CHOICES
A
EXIT LOOP

Figure 1

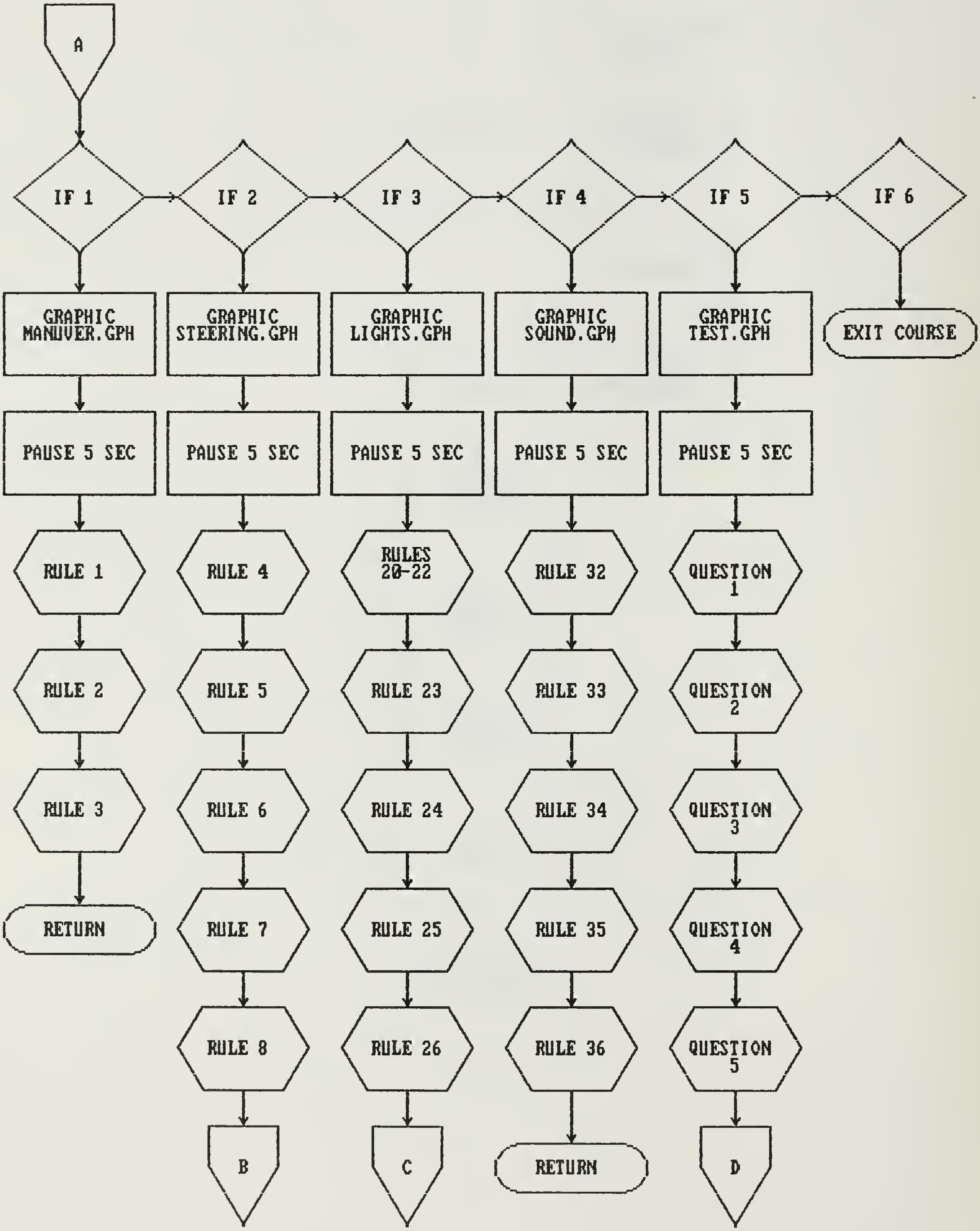

A
IF 1
IF 2
IF 3
IF 4
IF 5
IF 6
GRAPHIC MANUVER.GPH
GRAPHIC STEERING.GPH
GRAPHIC LIGHTS.GPH
GRAPHIC SOUND.GPH
GRAPHIC TEST.GPH
EXIT COURSE
PAUSE 5 SEC
PAUSE 5 SEC
PAUSE 5 SEC
PAUSE 5 SEC
PAUSE 5 SEC
RULE 1
RULE 2
RULE 3
RETURN
RULE 4
RULE 5
RULE 6
RULE 7
RULE 8
B
RULES 20-22
RULE 23
RULE 24
RULE 25
RULE 26
C
RULE 32
RULE 33
RULE 34
RULE 35
RULE 36
RETURN
QUESTION 1
QUESTION 2
QUESTION 3
QUESTION 4
QUESTION 5
D

Figure 2

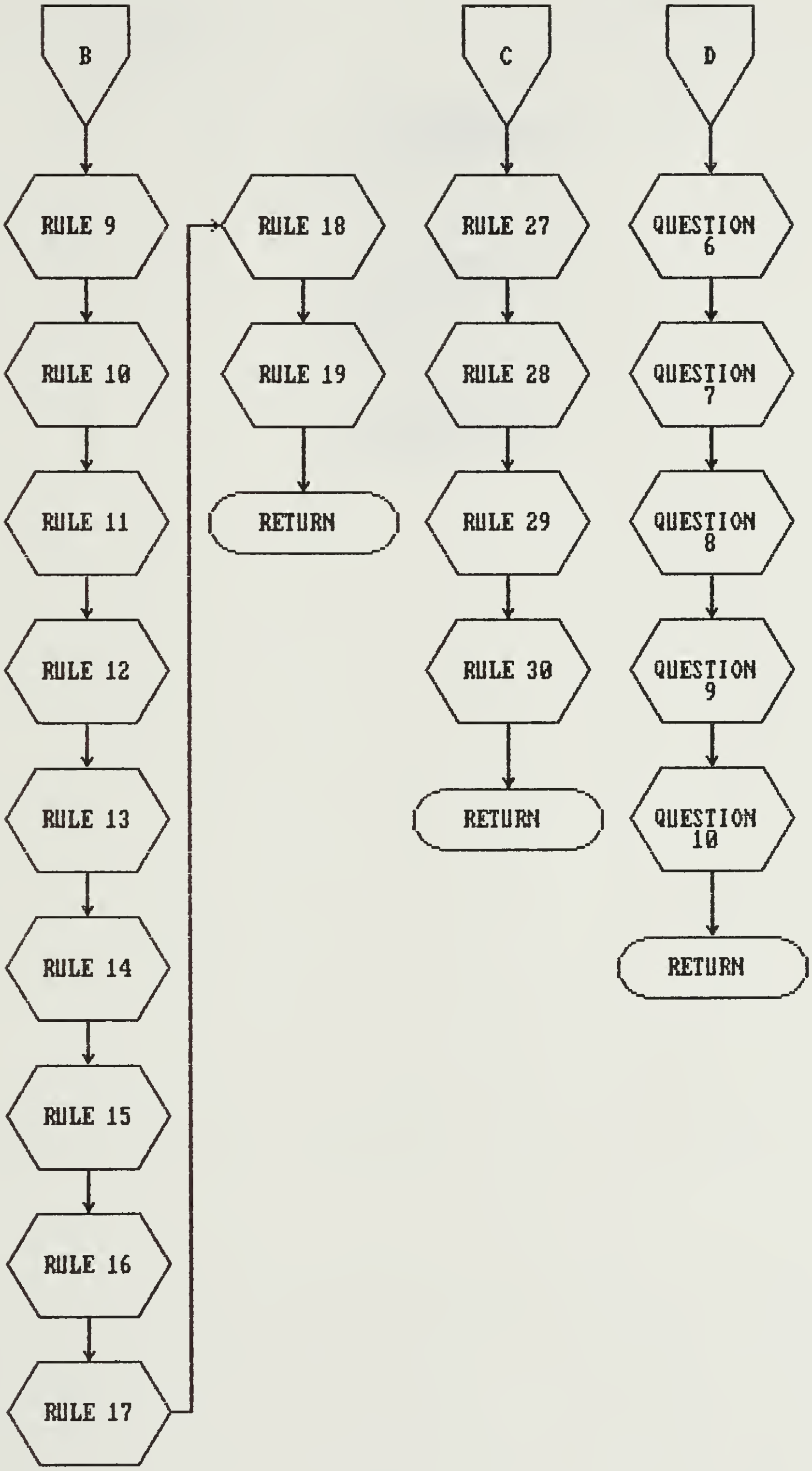

B
RULE 9
RULE 10
RULE 11
RULE 12
RULE 13
RULE 14
RULE 15
RULE 16
RULE 17
RULE 18
RULE 19
RETURN
C
RULE 27
RULE 28
RULE 29
RULE 30
RETURN
D
QUESTION 6
QUESTION 7
QUESTION 8
QUESTION 9
QUESTION 10
RETURN

Figure 3

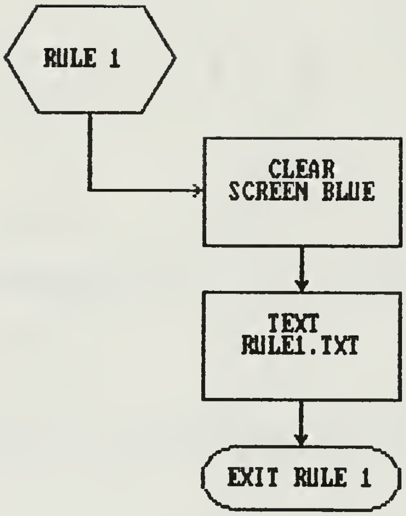


Figure 4

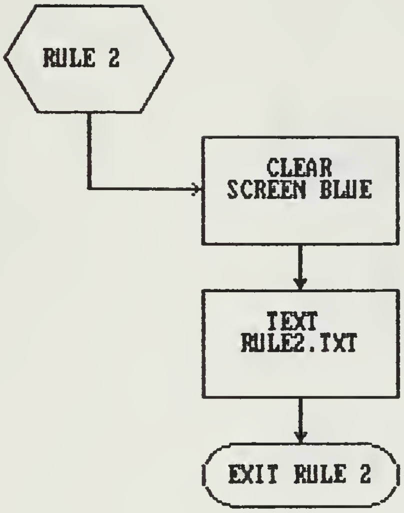
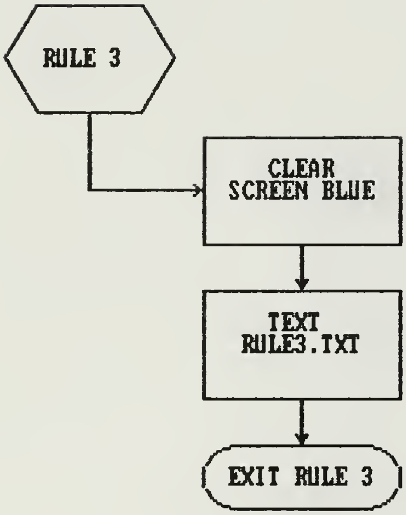


Figure 5



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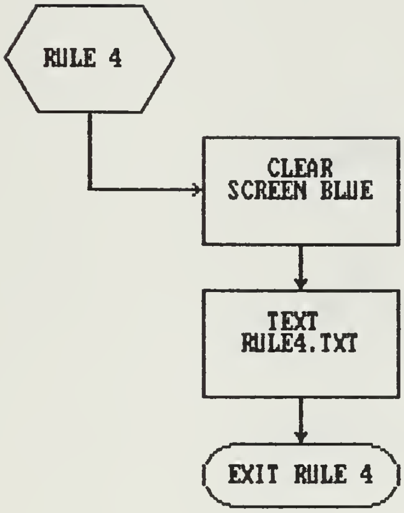

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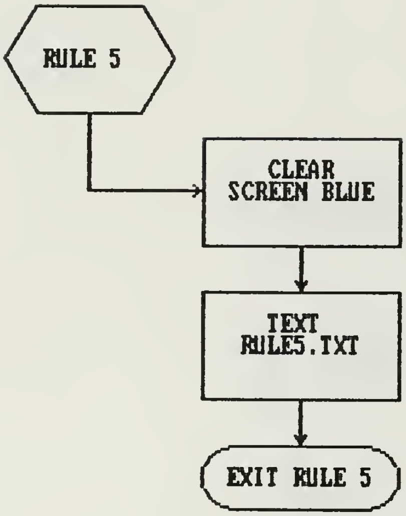

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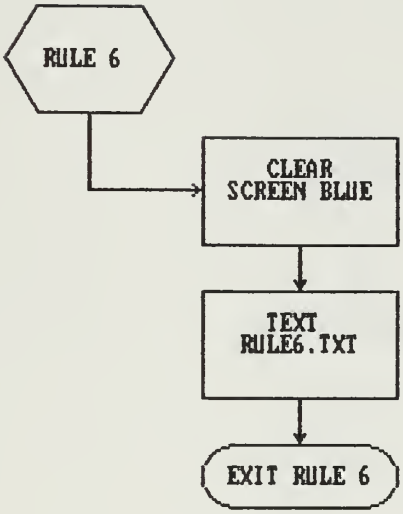

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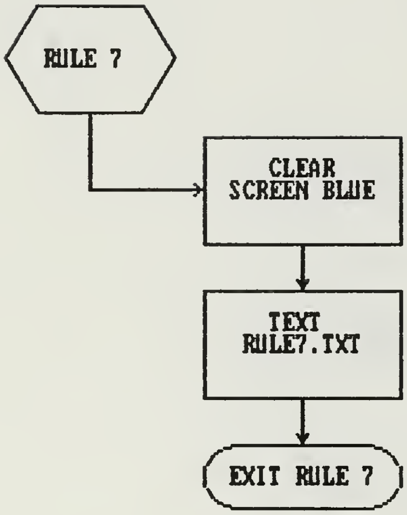

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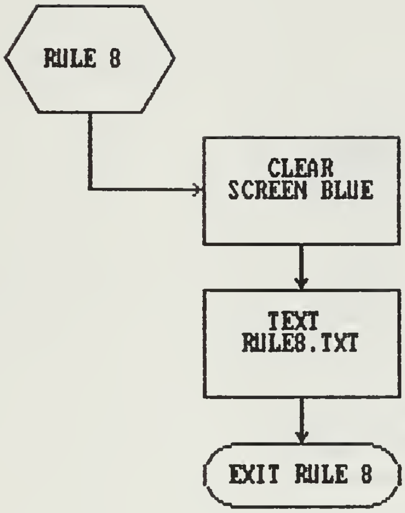

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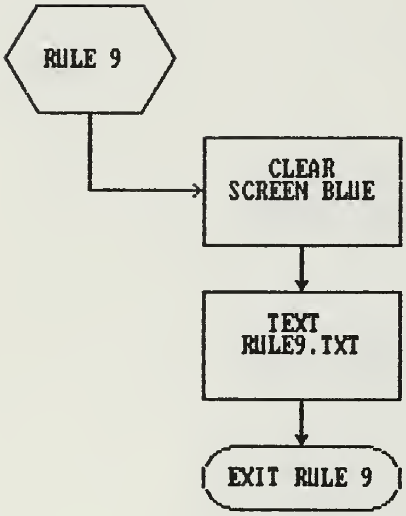

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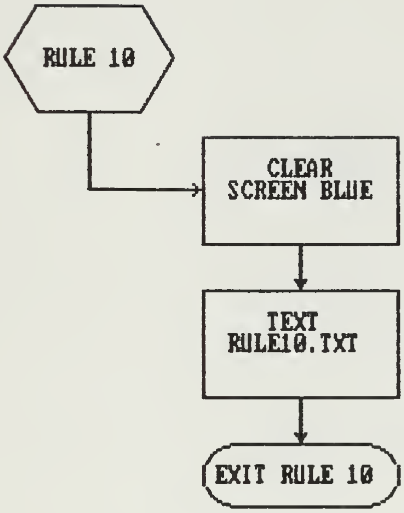
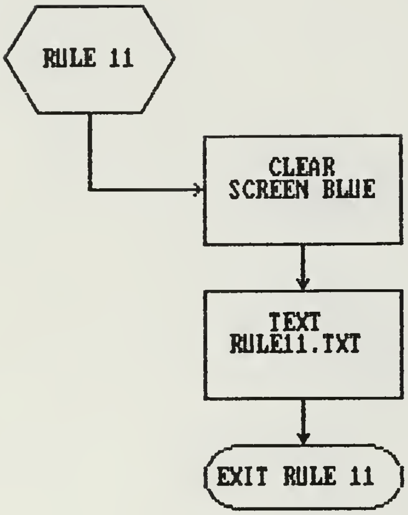


Figure 13



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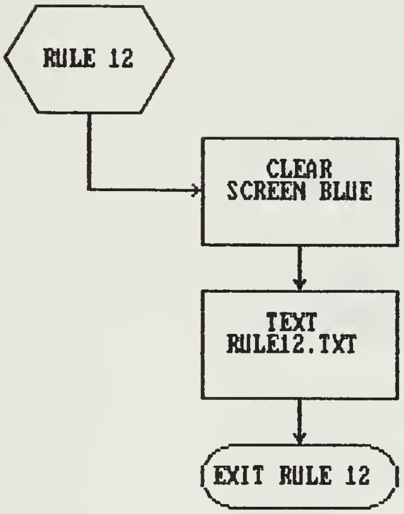

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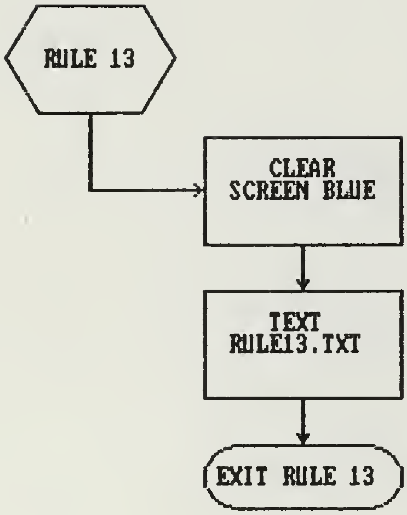

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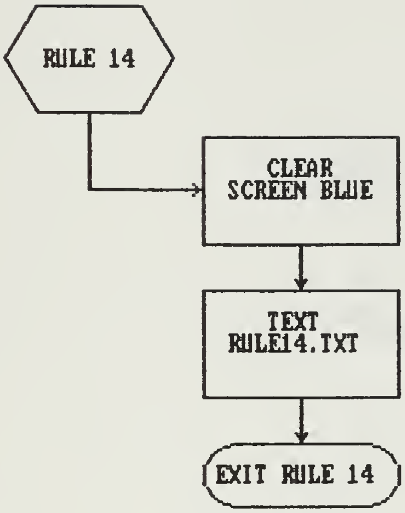

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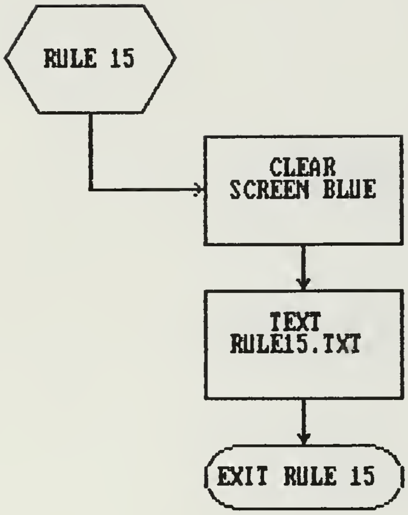

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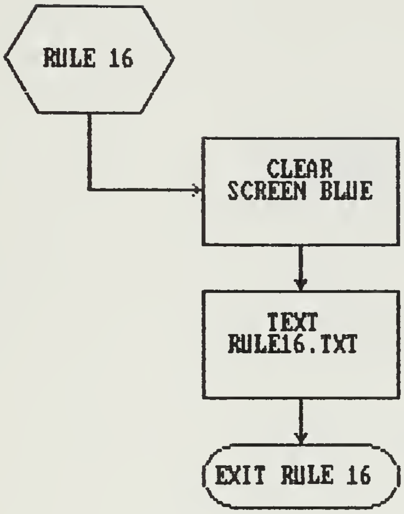

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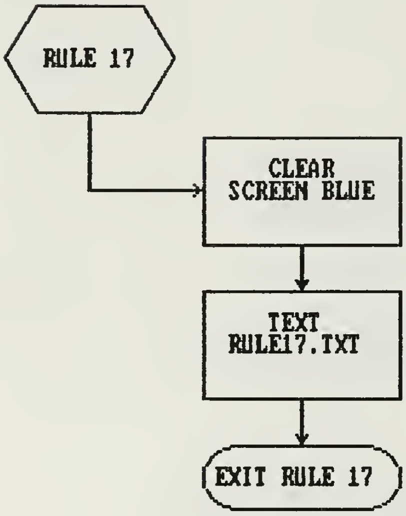

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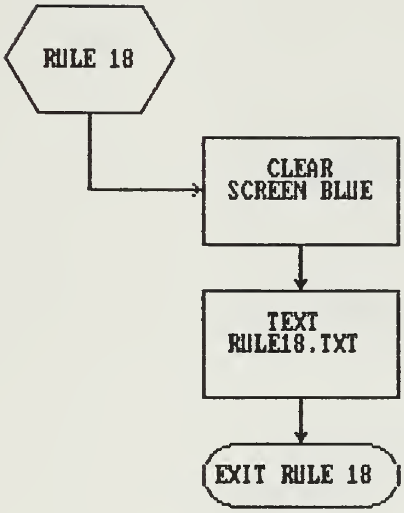
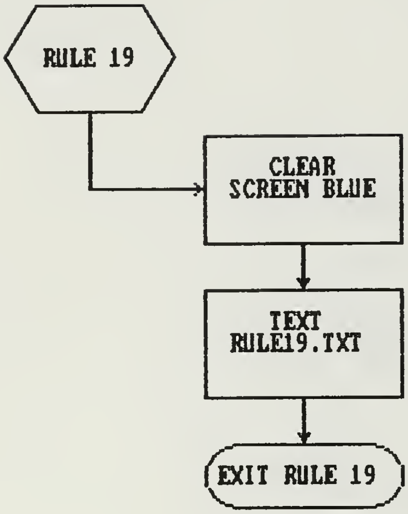


Figure 21



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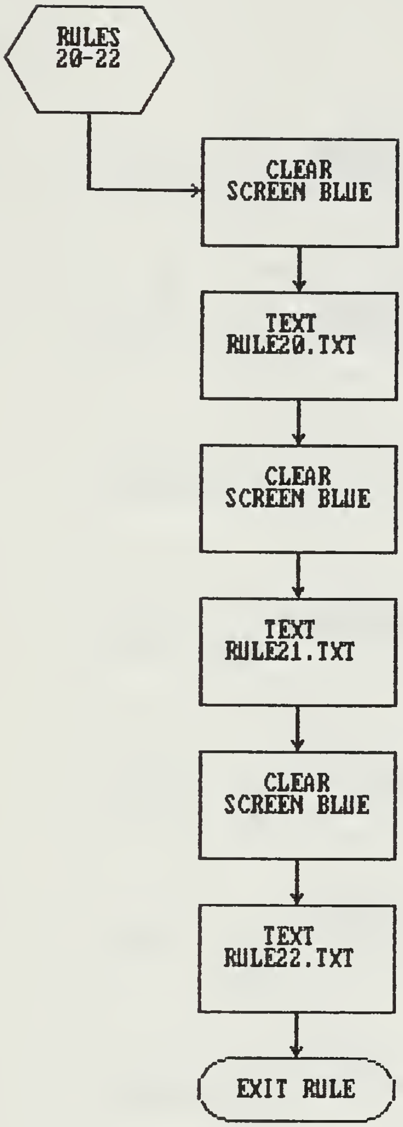

RULES 20-22
CLEAR SCREEN BLUE
TEXT RULE20.TXT
CLEAR SCREEN BLUE
TEXT RULE21.TXT
CLEAR SCREEN BLUE
TEXT RULE22.TXT
EXIT RULE

Figure 23

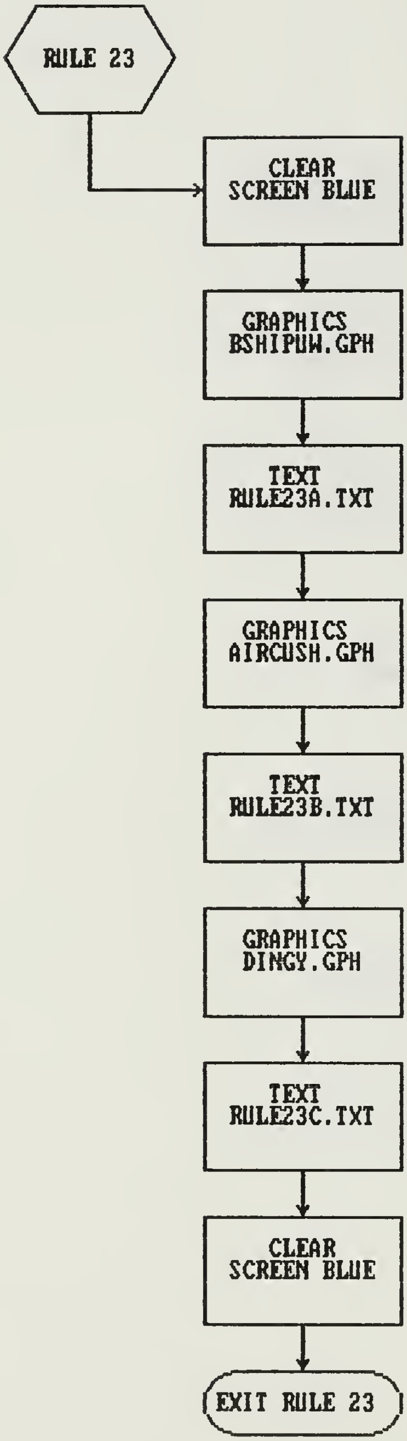

RULE 23
CLEAR SCREEN BLUE
GRAPHICS BSHIPUW.GPH
TEXT RULE23A.TXT
GRAPHICS AIRCUSH.GPH
TEXT RULE23B.TXT
GRAPHICS DINGY.GPH
TEXT RULE23C.TXT
CLEAR SCREEN BLUE
EXIT RULE 23

Figure 24

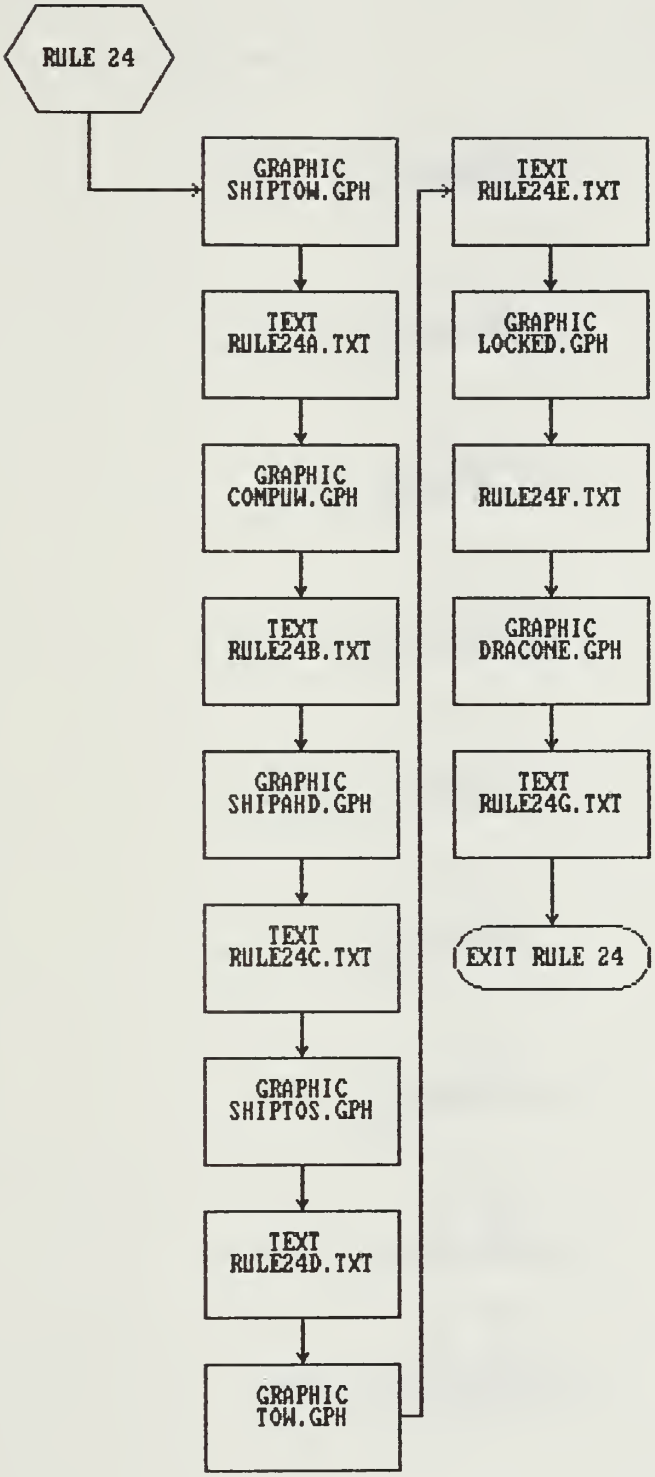

RULE 24
GRAPHIC SHIPTOW.GPH
TEXT RULE24A.TXT
GRAPHIC COMPUW.GPH
TEXT RULE24B.TXT
GRAPHIC SHIPAHD.GPH
TEXT RULE24C.TXT
GRAPHIC SHIPTOS.GPH
TEXT RULE24D.TXT
GRAPHIC TOW.GPH
TEXT RULE24E.TXT
GRAPHIC LOCKED.GPH
RULE24F.TXT
GRAPHIC DRACONE.GPH
TEXT RULE24G.TXT
EXIT RULE 24

Figure 25

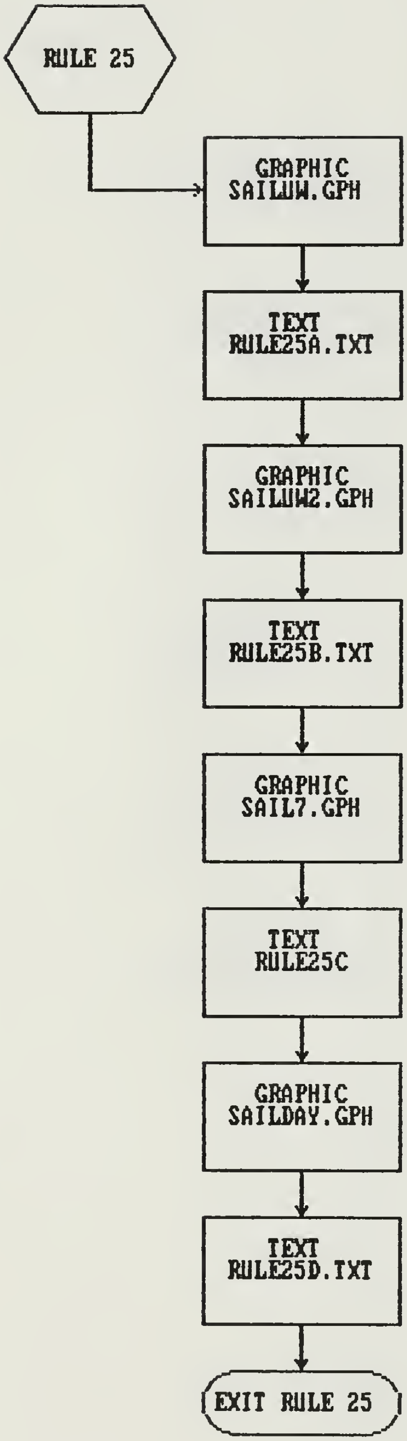

RULE 25
GRAPHIC SAILUW.GPH
TEXT RULE25A.TXT
GRAPHIC SAILUW2.GPH
TEXT RULE25B.TXT
GRAPHIC SAIL7.GPH
TEXT RULE25C
GRAPHIC SAILDAY.GPH
TEXT RULE25D.TXT
EXIT RULE 25

Figure 26

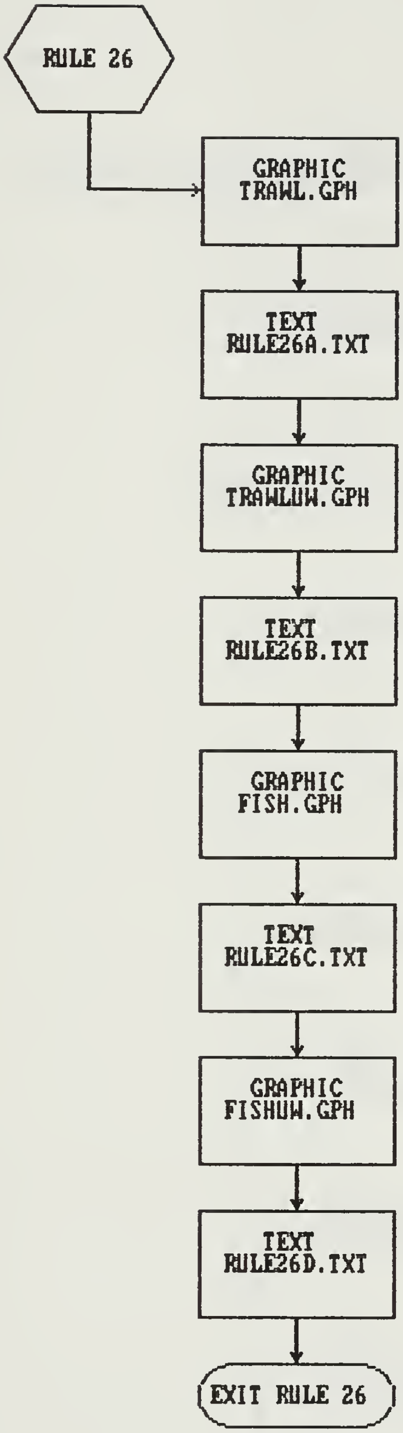

RULE 26
GRAPHIC
TRAWL.GPH
TEXT
RULE26A.TXT
GRAPHIC
TRAWLUW.GPH
TEXT
RULE26B.TXT
GRAPHIC
FISH.GPH
TEXT
RULE26C.TXT
GRAPHIC
FISHUW.GPH
TEXT
RULE26D.TXT
EXIT RULE 26

Figure 27

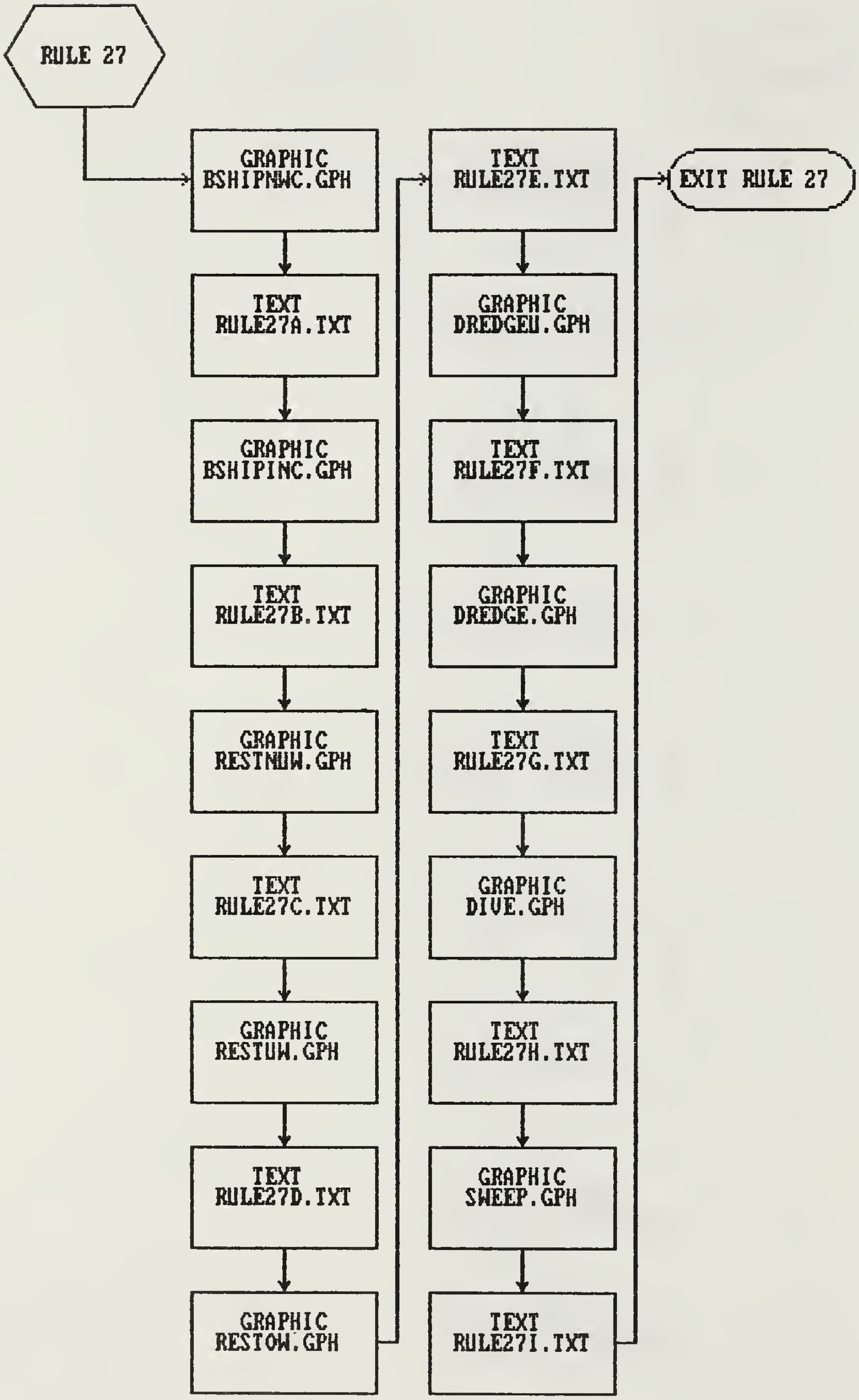
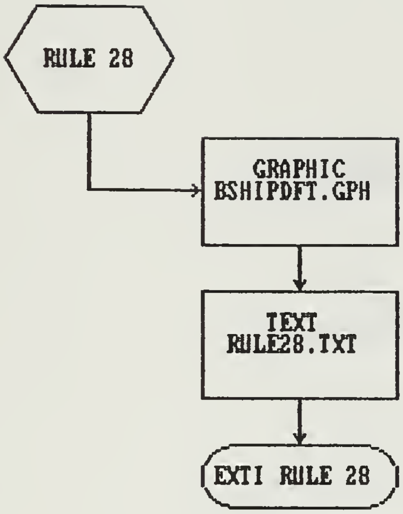

RULE 27
GRAPHIC BSHIPNWC.GPH
TEXT RULE27A.TXT
GRAPHIC BSHIPINC.GPH
TEXT RULE27B.TXT
GRAPHIC RESTNUW.GPH
TEXT RULE27C.TXT
GRAPHIC RESTUW.GPH
TEXT RULE27D.TXT
GRAPHIC RESTOW.GPH
TEXT RULE27E.TXT
GRAPHIC DREDGEU.GPH
TEXT RULE27F.TXT
GRAPHIC DREDGE.GPH
TEXT RULE27G.TXT
GRAPHIC DIUE.GPH
TEXT RULE27H.TXT
GRAPHIC SWEEP.GPH
TEXT RULE27I.TXT
EXIT RULE 27

Figure 28



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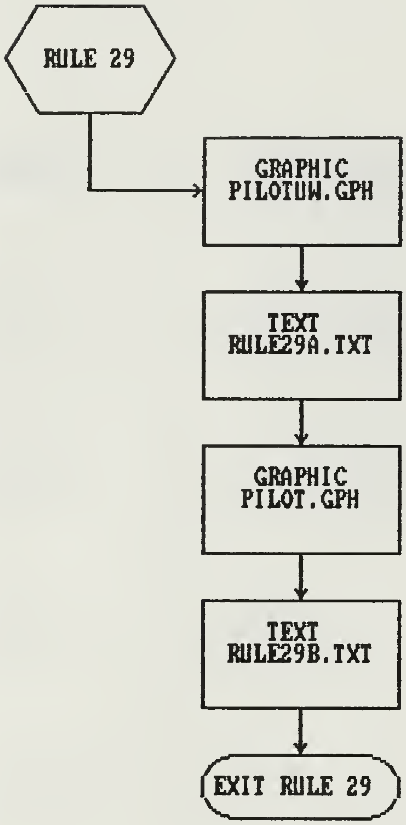

RULE 29
GRAPHIC PILOTUW.GPH
TEXT RULE29A.TXT
GRAPHIC PILOT.GPH
TEXT RULE29B.TXT
EXIT RULE 29

Figure 30

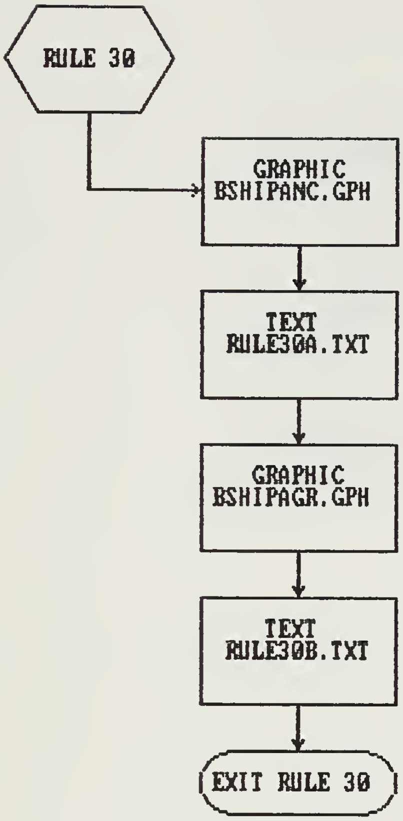
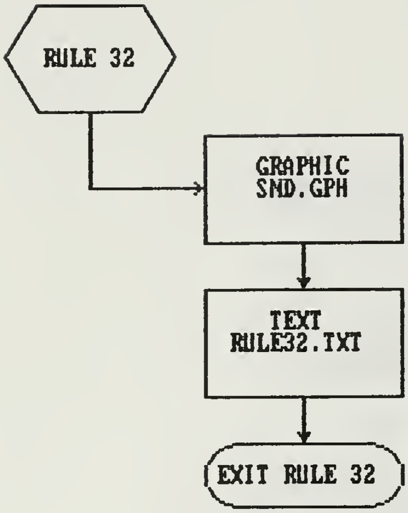

RULE 30
GRAPHIC BSHIPANC.GPH
TEXT RULE30A.TXT
GRAPHIC BSHIPAGR.GPH
TEXT RULE30B.TXT
EXIT RULE 30

Figure 31



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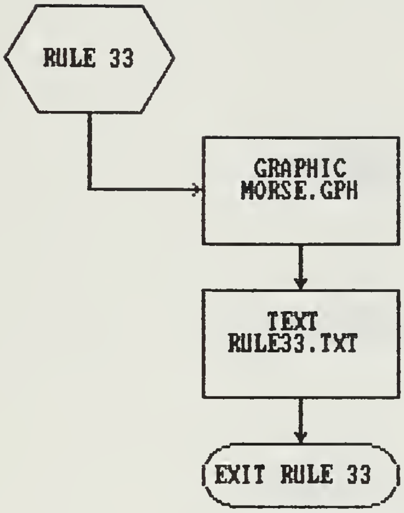

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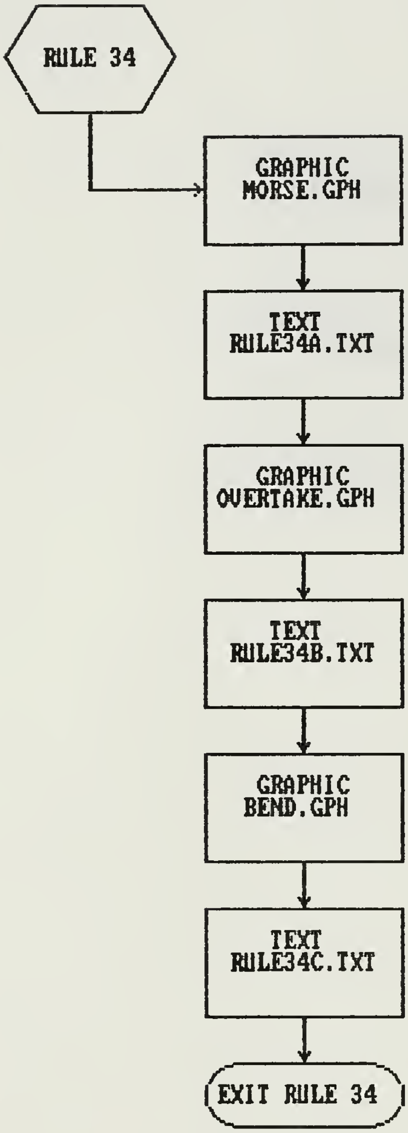
RULE 34
GRAPHIC MORSE.GPH
TEXT RULE34A.TXT
GRAPHIC OVERTAKE.GPH
TEXT RULE34B.TXT
GRAPHIC BEND.GPH
TEXT RULE34C.TXT
EXIT RULE 34

Figure 34

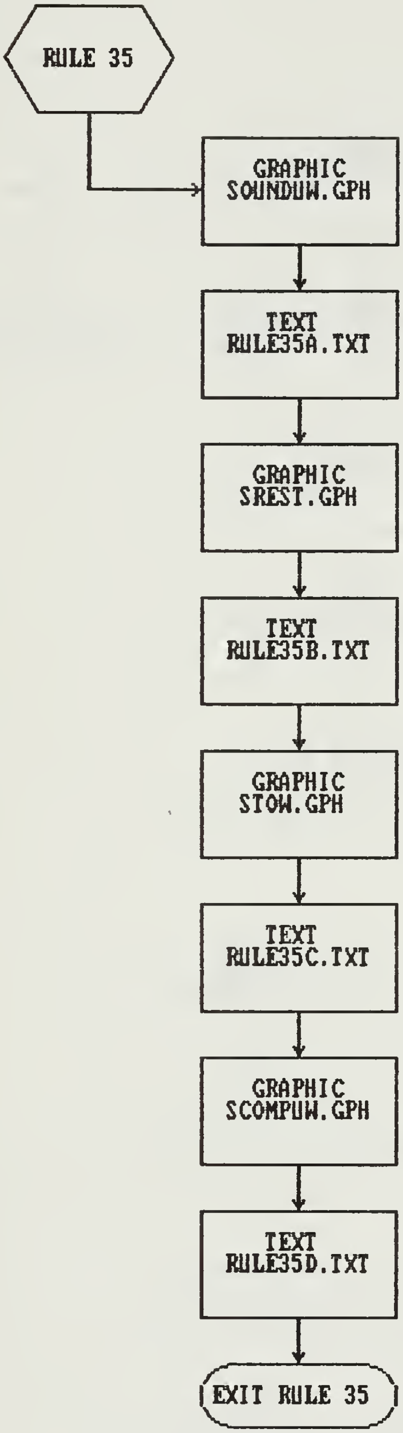
RULE 35
GRAPHIC SOUNDUW.GPH
TEXT RULE35A.TXT
GRAPHIC SREST.GPH
TEXT RULE35B.TXT
GRAPHIC STOW.GPH
TEXT RULE35C.TXT
GRAPHIC SCOMPUW.GPH
TEXT RULE35D.TXT
EXIT RULE 35

Figure 35

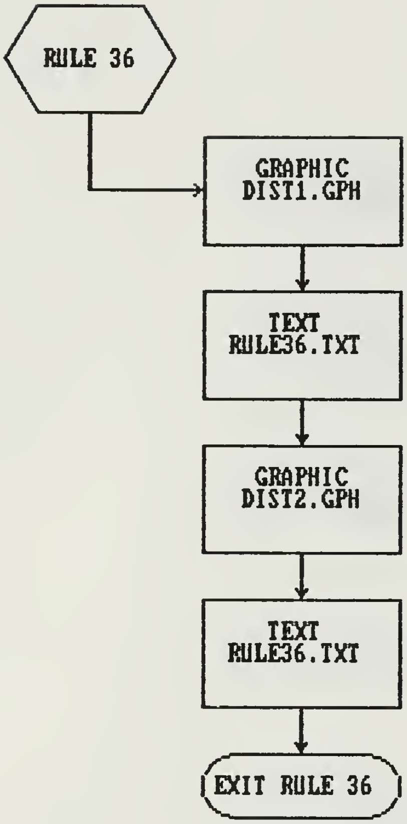
RULE 36
GRAPHIC DIST1.GPH
TEXT RULE36.TXT
GRAPHIC DIST2.GPH
TEXT RULE36.TXT
EXIT RULE 36

Figure 36

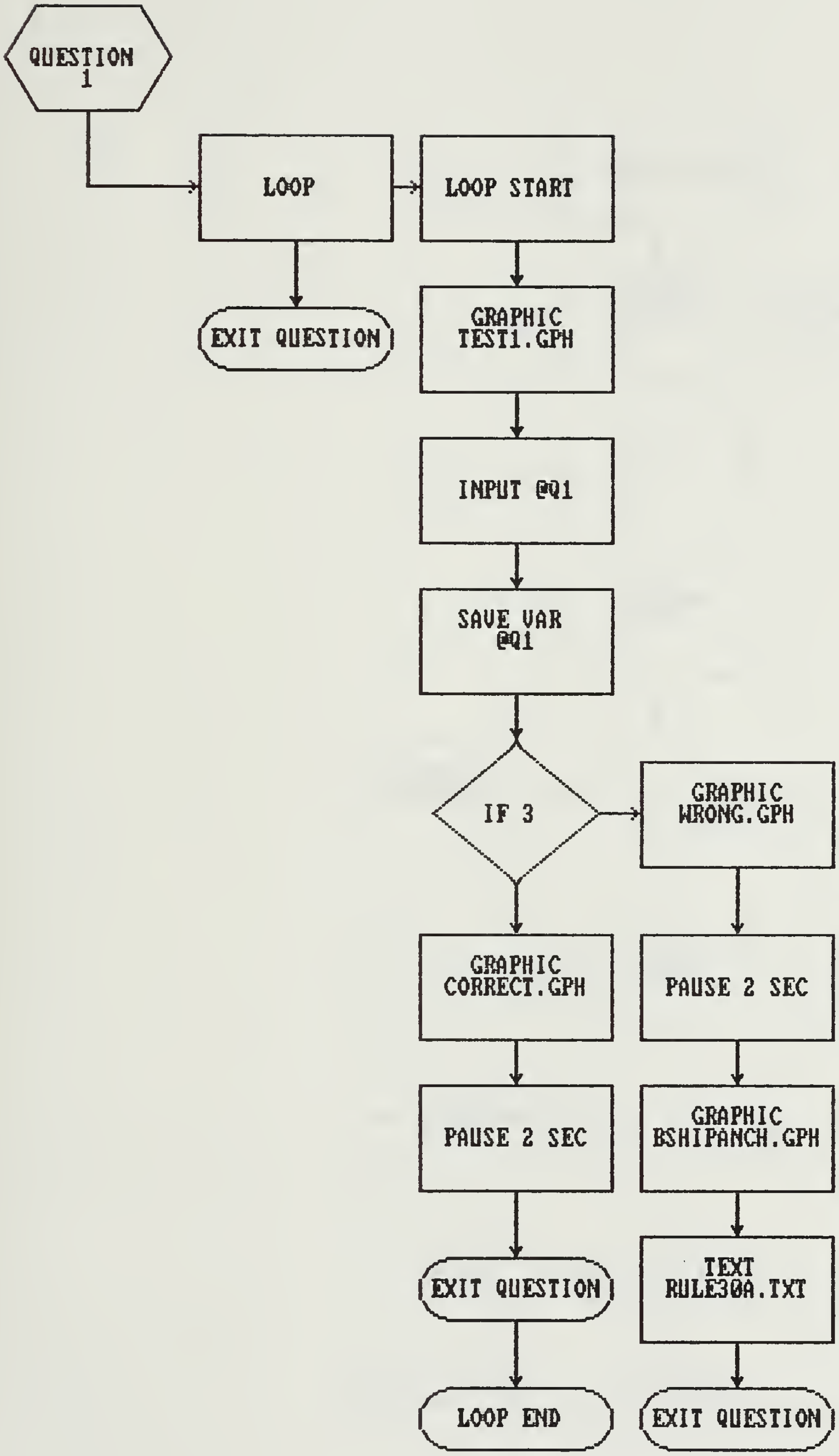
QUESTION 1
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST1.GPH
INPUT @Q1
SAVE VAR @Q1
IF 3
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC BSHIPANCH.GPH
EXIT QUESTION
TEXT RULE30A.TXT
LOOP END
EXIT QUESTION

Figure 37

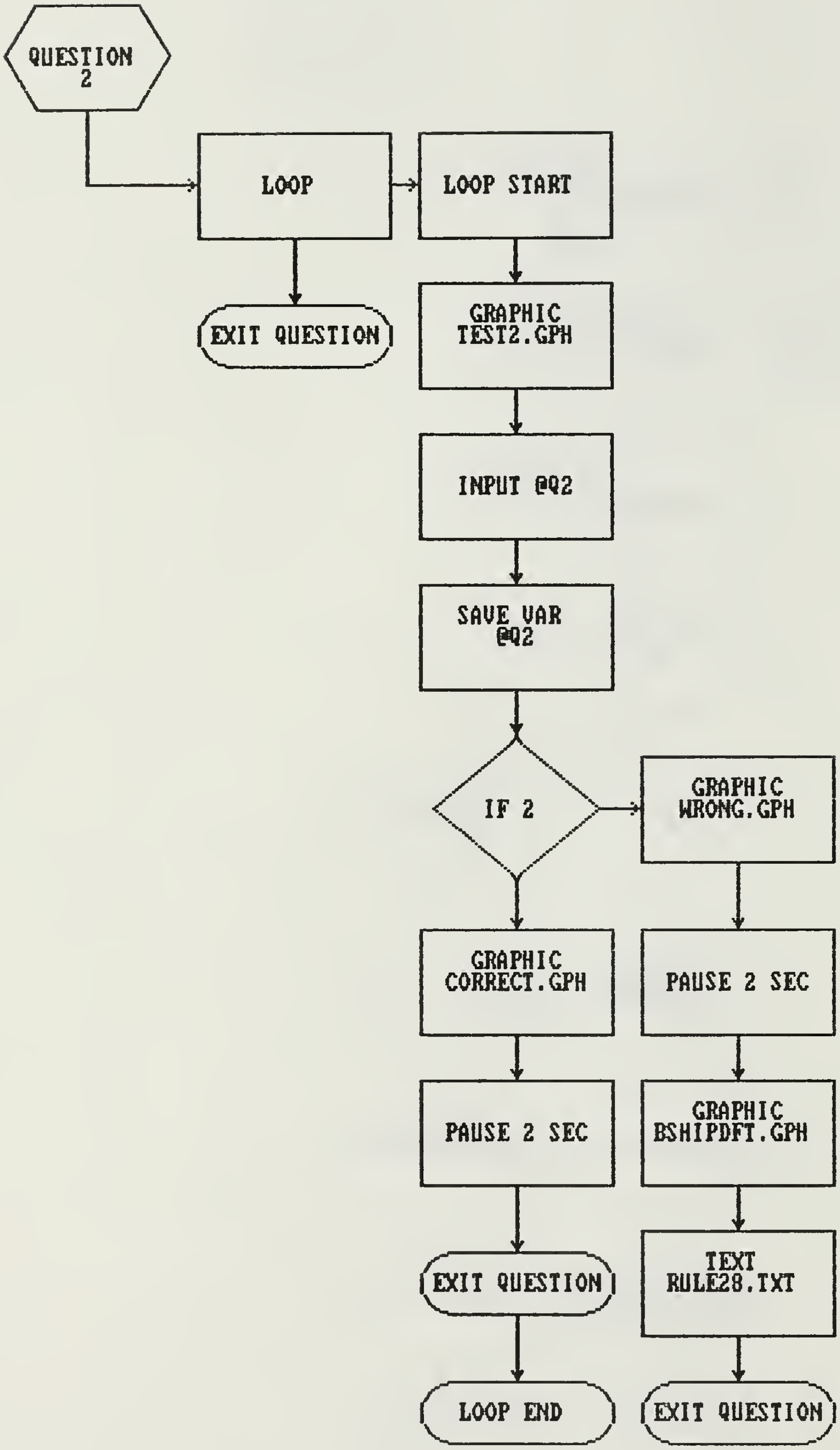
QUESTION 2
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST2.GPH
INPUT @Q2
SAVE VAR @Q2
IF 2
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC BSHIPDFT.GPH
EXIT QUESTION
TEXT RULE28.TXT
LOOP END
EXIT QUESTION

Figure 38

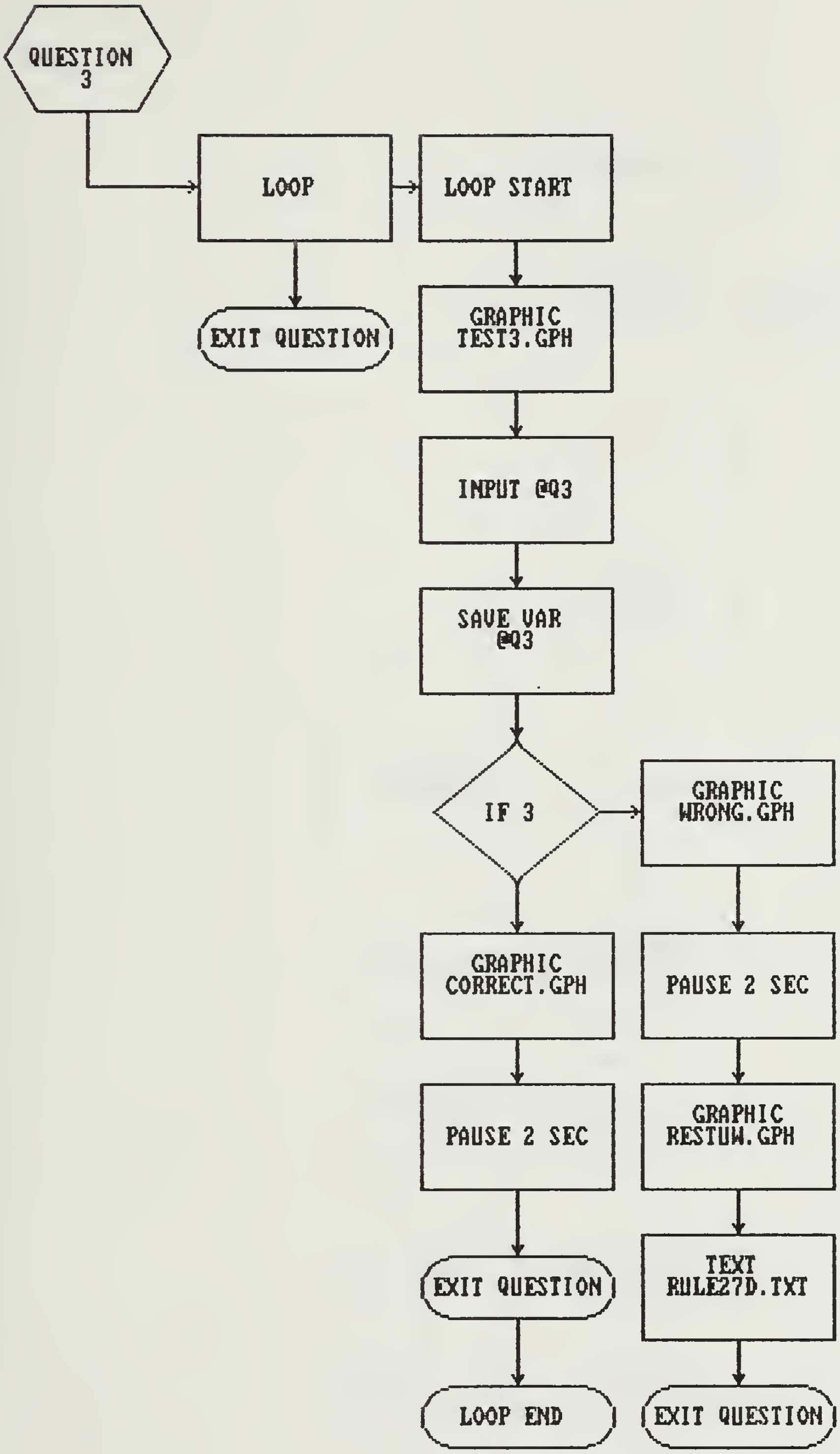
QUESTION 3
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST3.GPH
INPUT @Q3
SAVE VAR @Q3
IF 3
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC RESTUW.GPH
EXIT QUESTION
TEXT RULE27D.TXT
LOOP END
EXIT QUESTION

Figure 39

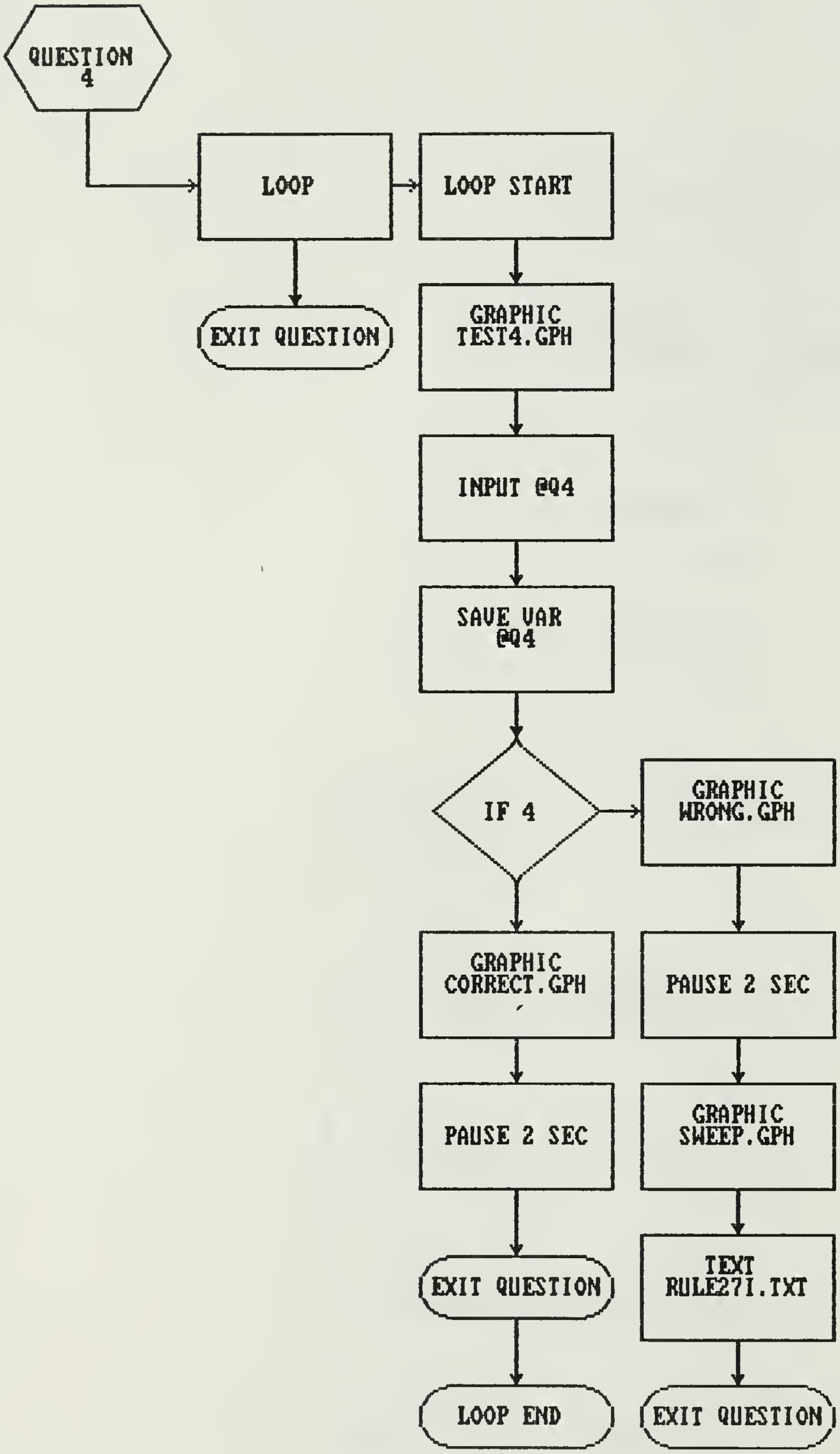
QUESTION 4
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST4.GPH
INPUT @Q4
SAVE VAR @Q4
IF 4
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC SWEEP.GPH
EXIT QUESTION
TEXT RULE27I.TXT
LOOP END
EXIT QUESTION

Figure 40

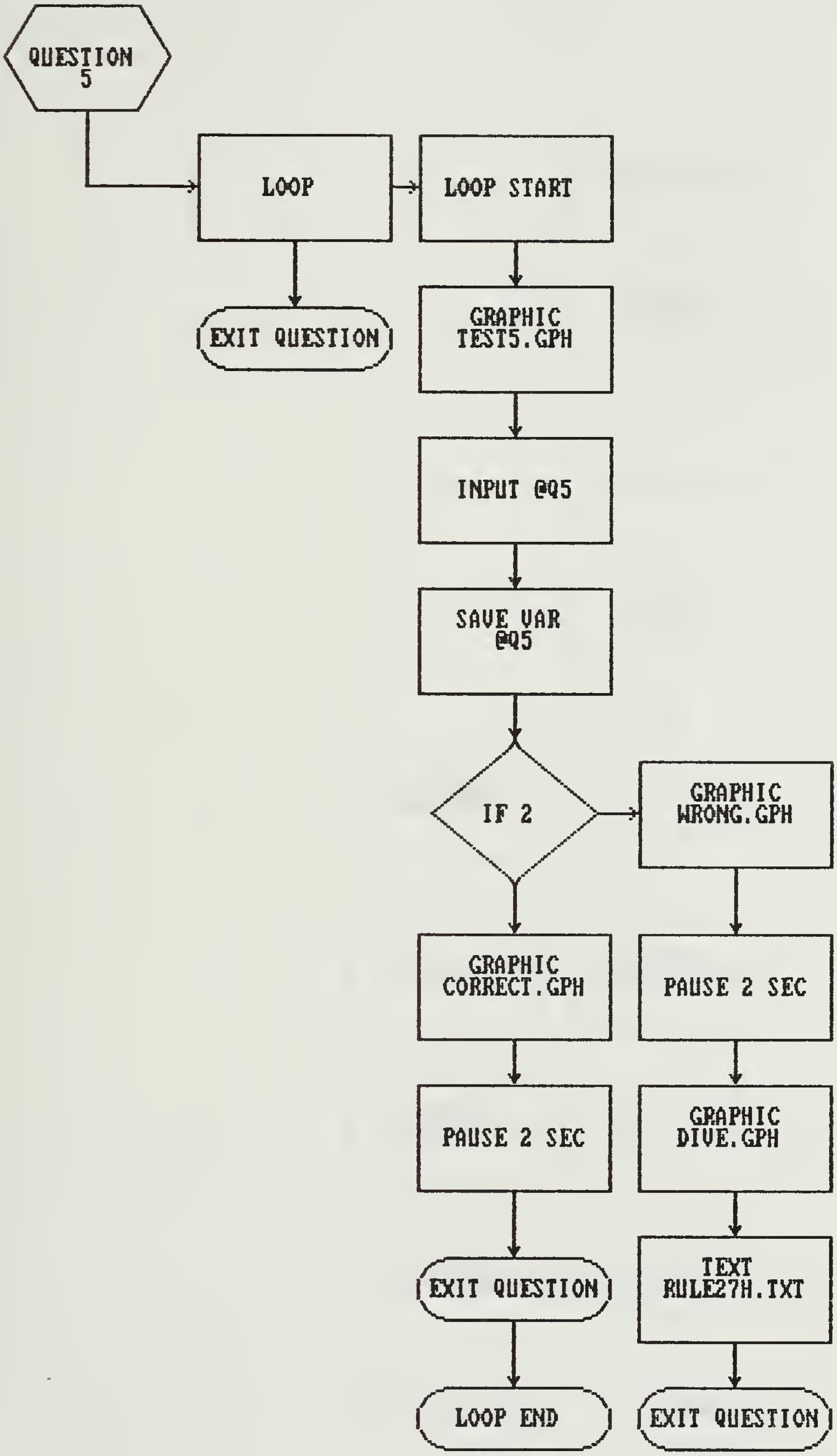
QUESTION 5
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST5.GPH
INPUT @Q5
SAVE VAR @Q5
IF 2
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC DIVE.GPH
EXIT QUESTION
TEXT RULE27H.TXT
LOOP END
EXIT QUESTION

Figure 41

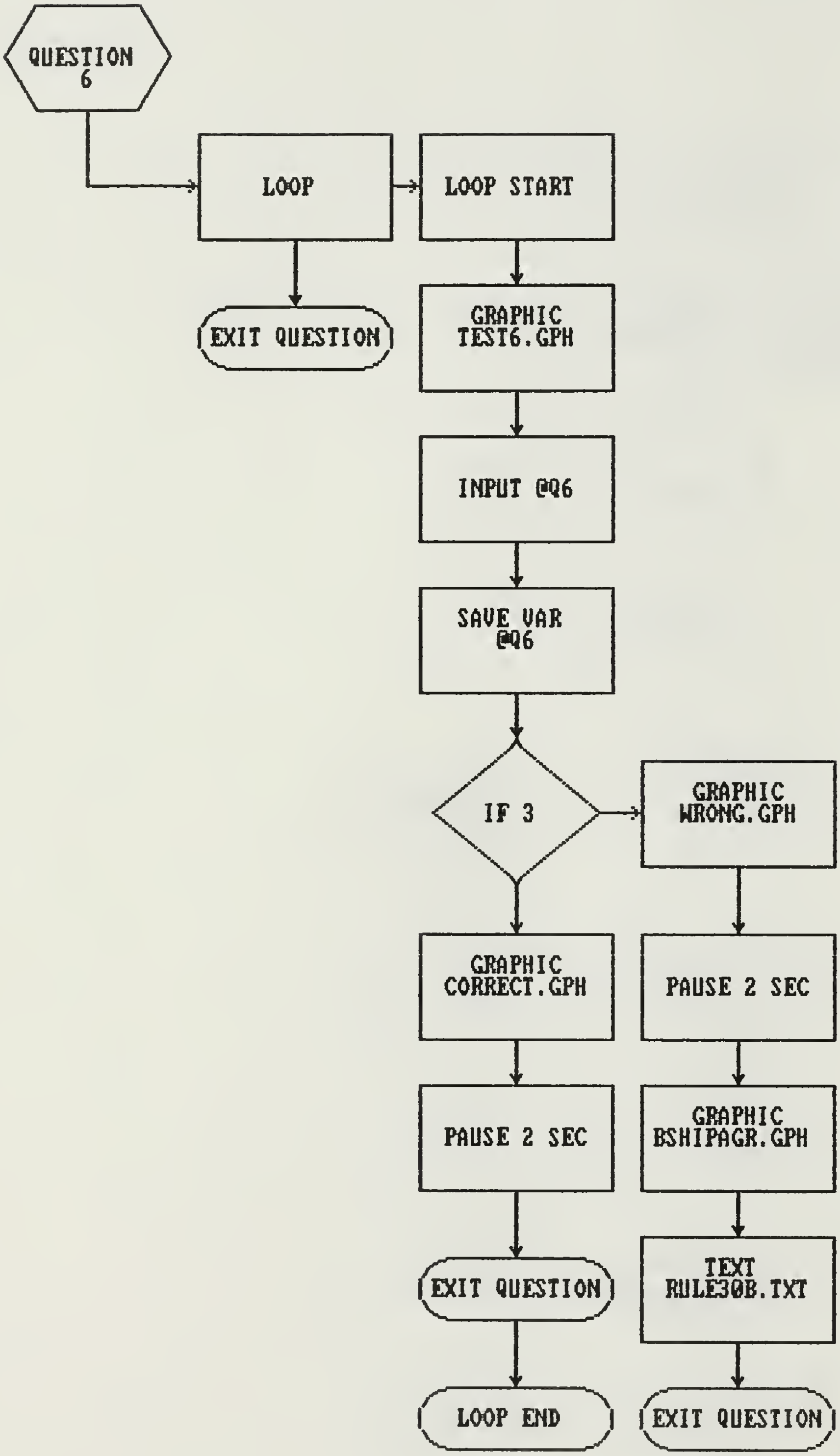
QUESTION 6
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST6.GPH
INPUT @Q6
SAVE VAR @Q6
IF 3
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC BSHIPAGR.GPH
EXIT QUESTION
TEXT RULE30B.TXT
LOOP END
EXIT QUESTION

Figure 42

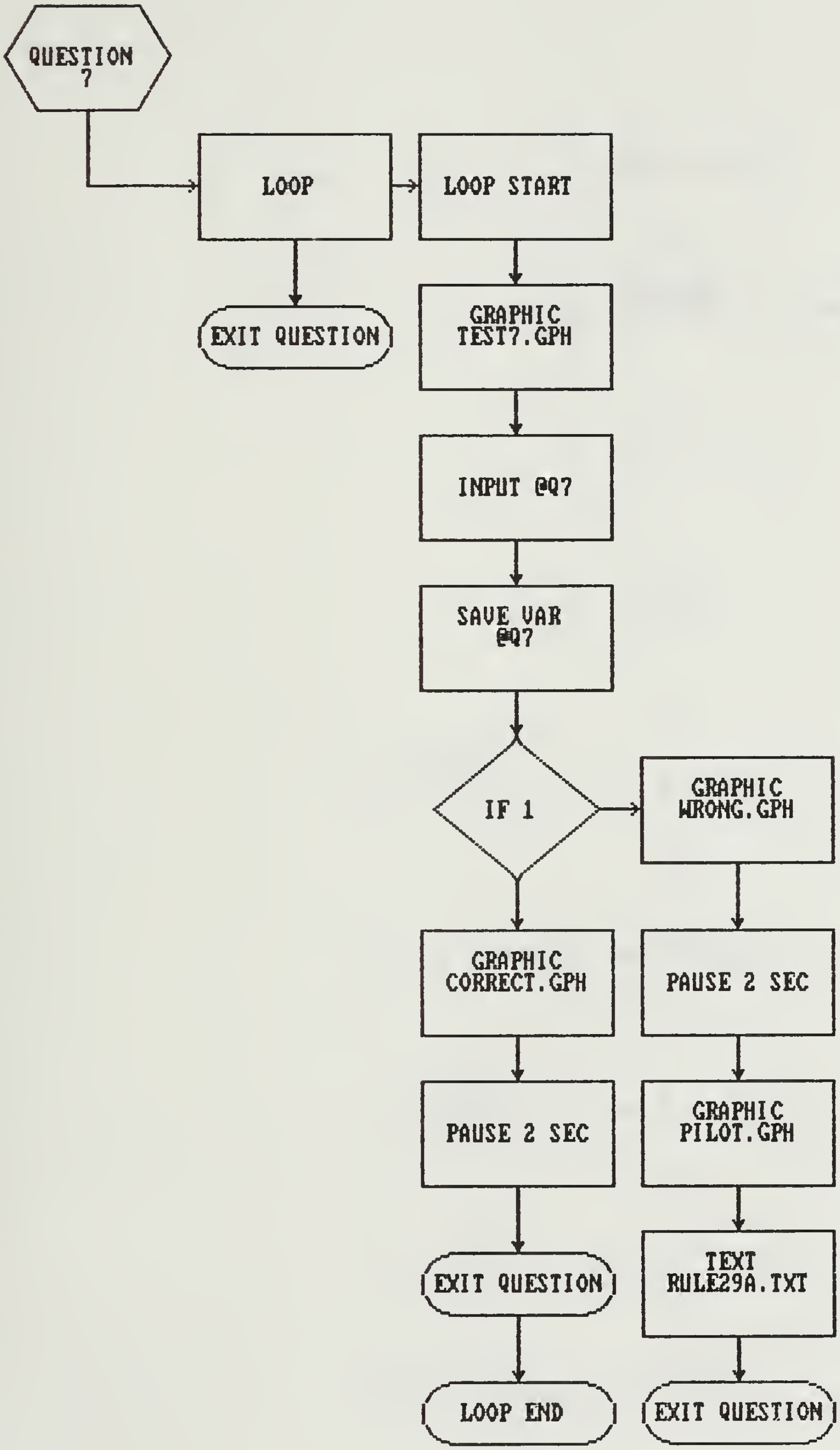
QUESTION 7
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST7.GPH
INPUT @Q7
SAVE VAR @Q7
IF 1
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC PILOT.GPH
EXIT QUESTION
TEXT RULE29A.TXT
LOOP END
EXIT QUESTION

Figure 43

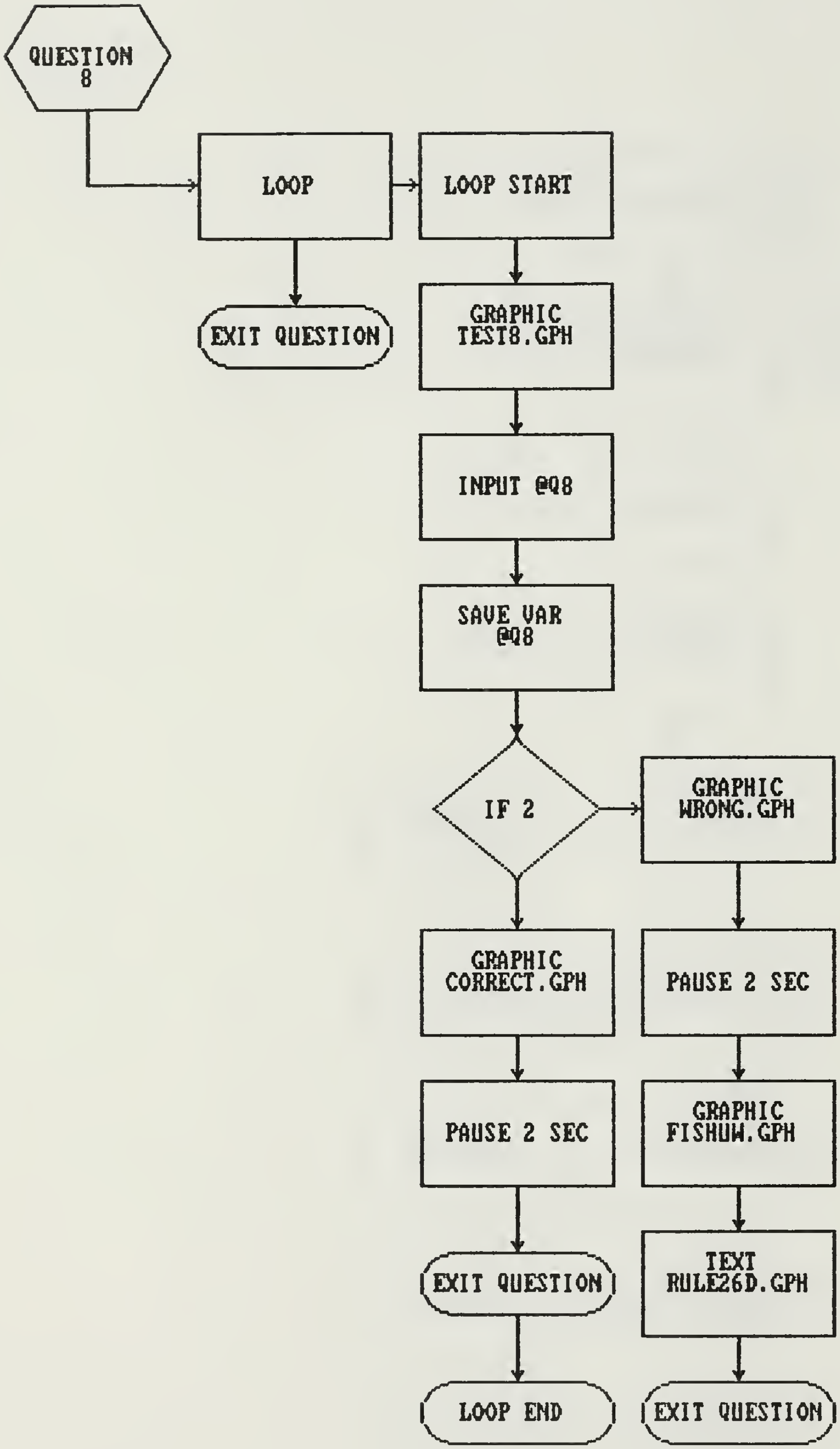
QUESTION 8
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST8.GPH
INPUT @Q8
SAVE VAR @Q8
IF 2
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC FISHUW.GPH
EXIT QUESTION
TEXT RULE26D.GPH
LOOP END
EXIT QUESTION

Figure 44

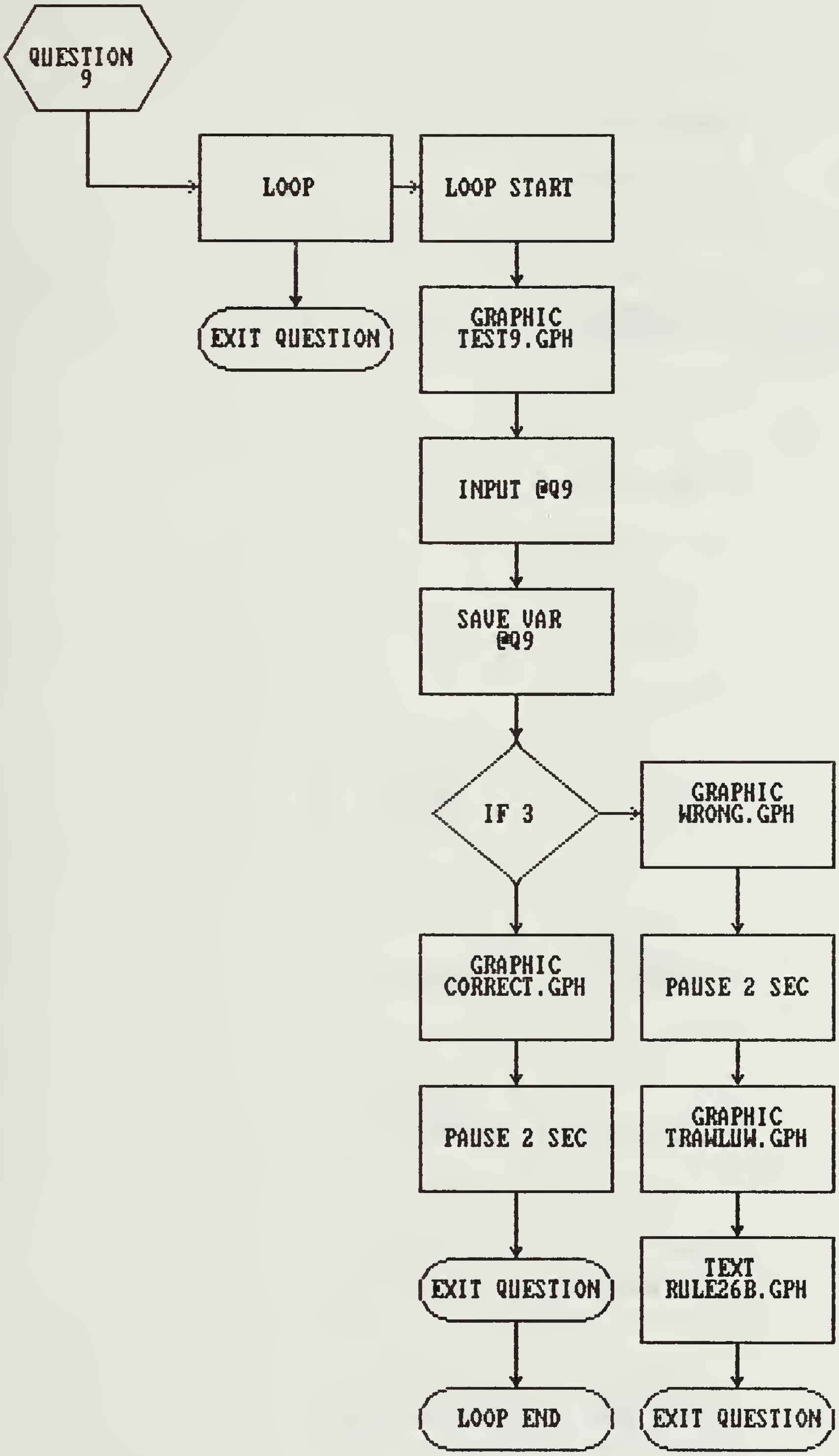
QUESTION 9
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST9.GPH
INPUT @Q9
SAVE VAR @Q9
IF 3
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC TRAWLUW.GPH
EXIT QUESTION
TEXT RULE26B.GPH
LOOP END
EXIT QUESTION

Figure 45

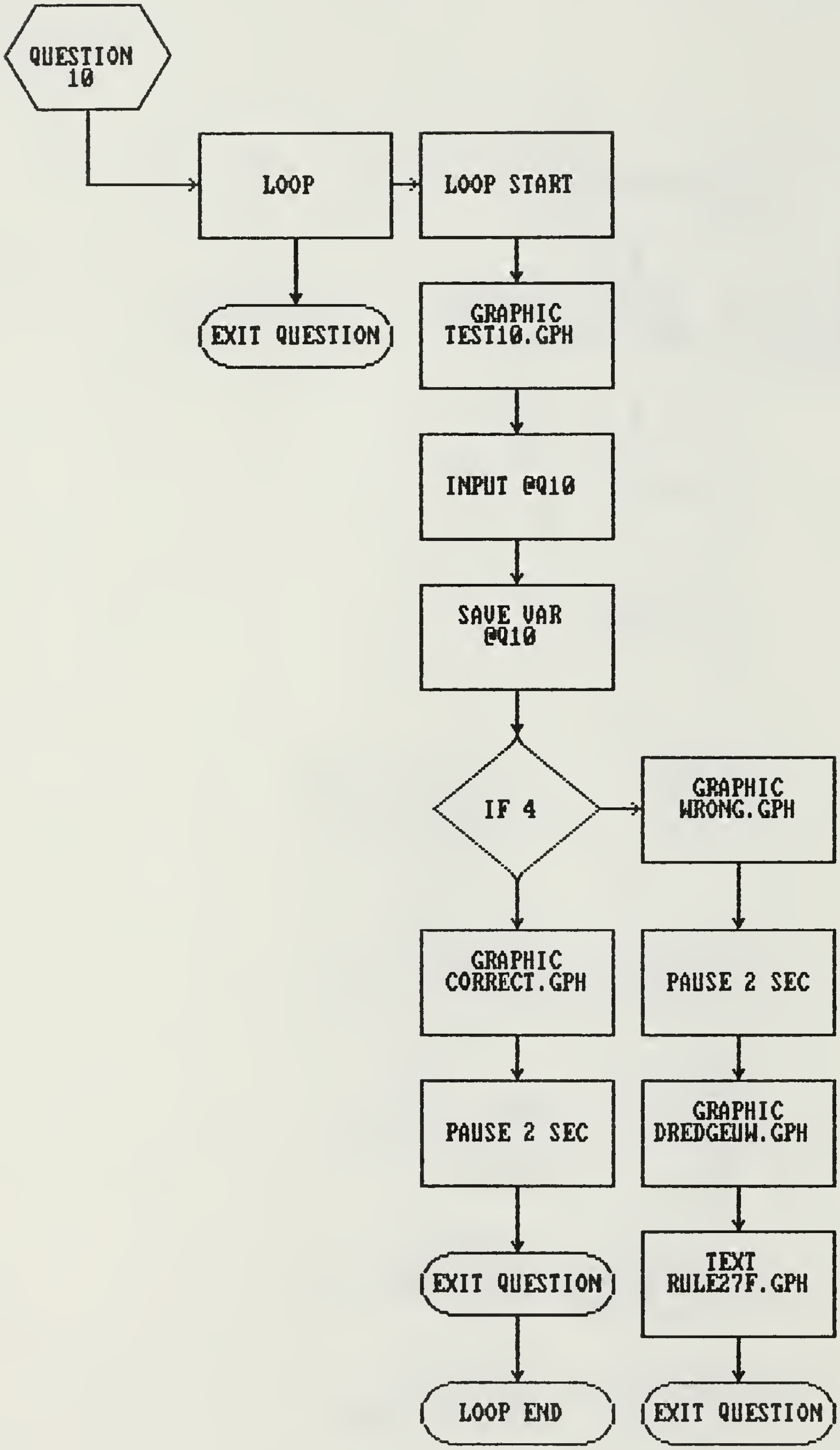
QUESTION 10
LOOP
LOOP START
EXIT QUESTION
GRAPHIC TEST10.GPH
INPUT @Q10
SAVE VAR @Q10
IF 4
GRAPHIC WRONG.GPH
GRAPHIC CORRECT.GPH
PAUSE 2 SEC
PAUSE 2 SEC
GRAPHIC DREDGEUW.GPH
EXIT QUESTION
TEXT RULE27F.GPH
LOOP END
EXIT QUESTION

Figure 46

LIST OF REFERENCES

1. AIMtech Corporation, Maestro/pc User Manual, 1986, 1987.
2. United States Coast Guard, Navigation Rules, U.S. Department of Transportation, 23 Dec 1983.

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